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The Journal of the Society of Dyers and Colourists

Volume 75 Number 9

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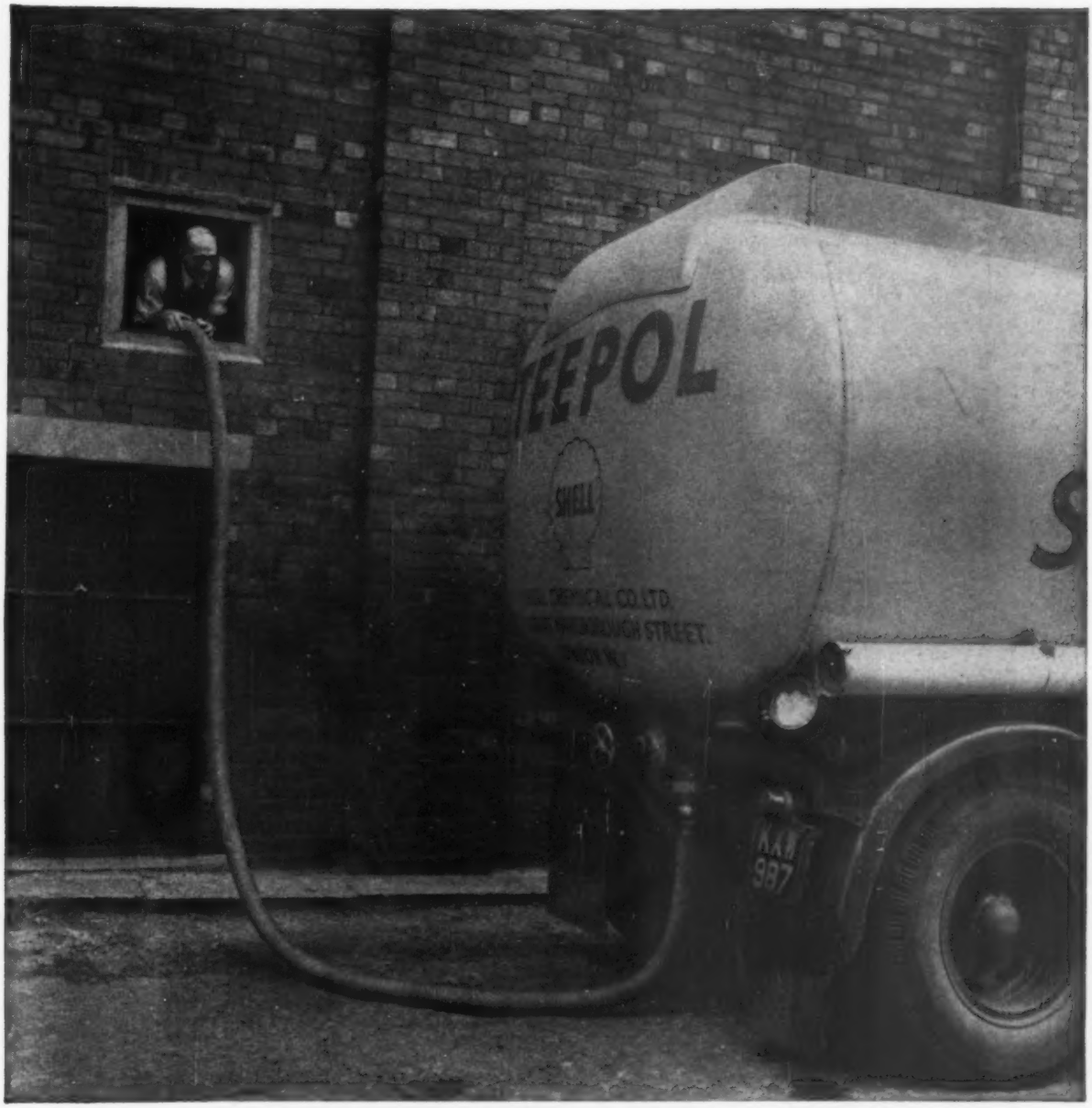

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THE SOCIETY OF DYERS AND COLOURISTS

SEVENTH LONDON LECTURE

Colour and Design in Wallpapers

by

Eric A. Entwisle Esq

Director, The Wallpaper Manufacturers Ltd

Friday 23 October 1959

THE WALDORF HOTEL
LONDON WC2

7 pm

The Journal of the Society of Dyers and Colourists

(Subscription rates for non-members £5 5s 0d per annum, post free)
(Abstracts section only printed on one side of paper— £2 0s 0d per annum)

NOTICE TO MEMBERS AND SUBSCRIBERS

Readers requiring *general information* regarding the Official Notices, List of Officers of the Society, etc, should consult pages 1–10 of the January 1959 and pages 341–348 of the July 1959 issues of the *Journal*, or write to *The General Secretary*, The Society of Dyers and Colourists, Dean House, 19 Piccadilly, Bradford 1, Yorkshire (*Telephone* Bradford 25138). *Editorial Communications* should be addressed to *The Editor*, at the same address

Forthcoming Papers

The following papers have been accepted by the Publications Committee, and will appear in future issues of the *Journal*—

LECTURES

Jigger Studies
I— Watering of Cellulose Acetate Poult Fabrics. Cause and Prevention — *E. France*

New Ideas in the Application of Phthalocyanine Derivatives to Textiles — *F. Gund*

Some Recent Advances in Textile Printing — *R. J. Hannay*

Tests for Colour Vision — *F. Jordinson and T. Minshall*

Some Relations between the Chemical Constitution of Cibacron Dyes and their Dyeing Characteristics — *J. Wegmann*

COMMUNICATIONS

Chemical Modification of Flax Cellulose
I— Action of Acrylonitrile, Chloroacetic Acid and β-Propiolactone
N. Gokal and J. K. Skelly

Studies on Haematoxylin and Haematein, the Colouring Principles of Logwood

I— Absorption Spectra of Pure Compounds in Various Solvents and a Spectrophotometric Method of Analysis for Haematoxylin and Haematein

II— Behaviour in Aqueous Solution at Varying pH and pK Values
G. C. Lalor and S. L. Martin

The Separation, Estimation, Orientation, and Ultraviolet Spectra of Isomeric Azo Compounds formed by Coupling to 1-Naphthylamine and its Derivatives
E. R. Ward, B. D. Pearson, and P. R. Wells

FORTHCOMING MEETINGS OF THE SOCIETY

Thursday, 22nd October 1959

WEST RIDING SECTION. *The Development of a new Shrink-resist Finish from the Laboratory to the Mill.* A. N. Davidson, Esq., B.Sc. (W.I.R.A.). Victoria Hotel, Bridge Street, **Bradford 1.** 7.30 p.m.

MANCHESTER JUNIOR BRANCH. *The Scope for the Junior Technologist in the Textile Industry.* F. M. Stevenson Esq., M.Sc., J.P., The President Elect. Room J/B 16, Chemical Engineering Building (Jackson Street), College of Science and Technology, **Manchester.** 4.30 p.m.

Friday, 23rd October 1959

NORTHERN IRELAND SECTION. Dinner Dance. Woodbourne House Hotel.

LONDON SECTION. The Seventh London Lecture. *Colour and Design in Wallpapers.* Eric A. Entwisle, Esq. (Director, The Wallpaper Manufacturers Ltd.). The Waldorf Hotel, **London W.C.2.** 7 p.m.

Wednesday, 28th October 1959

MIDLANDS SECTION. *Developments in Recent Trends in the Dyeing of Wool.* W. Beal, Esq., B.Sc. King's Head, **Loughborough.** 7 p.m.

Thursday, 29th October 1959

MANCHESTER JUNIOR BRANCH. Cibacron Dyestuffs Exhibition (CIBA Clayton Ltd.). Belle Vue, **Manchester.**

Friday, 6th November 1959

LONDON SECTION. *The Use of Colour in Cosmetics.* D. F. Anstead, Esq., B.Sc., A.R.I.C. Royal Society, Burlington House, **London W.1.** 6 p.m.

WEST RIDING SECTION. ONE DAY CONFERENCE. CREASE RETENTION AND CREASE SHEDDING. *The Permanent Creasing of Wool Fabrics.* Professor J. B. Speakman (Department of Textile Industries, Leeds University). *Crease Retention and Flat Setting of Pure Wool Fabrics.* Dr. A. J. Farnworth (Principal Research Officer, Commonwealth Scientific and Industrial Research Organisation, Australia). *New Reactants and Finishing Agents.* W. A. Bragg, Esq. (Warwick Chemicals (Yorkshire) Ltd.). *The Crease recovery of Wet Fabrics.* Dr. W. Lonie (British Rayon Research Association). Leeds University, **Leeds 2.** 2 p.m.

Monday, 9th November 1959

HUDDERSFIELD SECTION. *The Dyeing of Man-made Fibres.* H. Birchall, Esq. (Wm. North & Sons Ltd). Invitation from the Halifax Textile Society. Joint meeting at The Alexandra Hall, **Halifax.** 7.30 p.m.

Tuesday, 10th November 1959

NORTHERN IRELAND SECTION. *The Theory and Practice of Sodium Chlorite Bleaching.* J. K. Skelly, Esq., M.Sc., Ph.D., A.R.I.C., F.S.D.C. (College of Technology, Belfast). Grosvenor Rooms, **Belfast.** 7.30 p.m.

Thursday, 12th November 1959

MANCHESTER JUNIOR BRANCH. *A New Mechanism of Detergency.* A. S. C. Lawrence Esq., Ph.D., Sc.D., F.R.I.C., F.Inst.Pet. Room J/B 16, Chemical Engineering Building (Jackson Street), College of Science and Technology, **Manchester.** 4.30 p.m.

SCOTTISH JUNIOR BRANCH. *The Development of a New Shrink-resist Finish from the Laboratory to the Mill.* A. N. Davidson, Esq., B.Sc. (Wool Industries Research Association). Technical College, **Paisley.** 7.30 p.m.

WEST RIDING SECTION. *An investigation into the Application of Logwood to Dicel and Nylon Fabrics.* E. France, Esq. (Courtaulds Ltd., Bocking). Victoria Hotel, Bridge Street, **Bradford 1.** 7.30 p.m.

Tuesday, 17th November 1959

BRADFORD JUNIOR BRANCH. *An Investigation into the Application of Logwood to Dicel and Nylon Fabrics.* E. France, Esq. (Courtaulds Ltd.). Institute of Technology, **Bradford.** 7.15 p.m.

SCOTTISH SECTION. *The Finishing of Fabrics containing Short Staple Terylene.* D. Clegg, Esq., M.Sc., A.T.I. (Imperial Chemical Industries Ltd.). St. Enoch Hotel, **Glasgow.** 7.15 p.m.

HUDDERSFIELD SECTION. *Recent Developments in Wool Dyeing.* D. G. Evans, Esq., B.Sc. (CIBA Clayton Ltd.). Silvios Cafe, Westgate, **Huddersfield.** 7.30 p.m.

Wednesday, 18th November 1959

MIDLANDS SECTION. *Identification of Dispersed Dyes.* W. L. Lead, Esq., Ph.D., F.R.I.C., D. Haig, Esq., F.T.I., F.S.D.C., L. A. Telesz, Esq., F.T.I. College of Technology, **Leicester.** 7 p.m.

Thursday, 26th November 1959

WEST RIDING SECTION. *The Principles of Colour Photography.* D. P. Ayres, Esq., B.Sc. (Ilford Ltd.). Griffin Hotel, Boar Lane, **Leeds 1.** 7.30 p.m.

Friday, 4th December 1959

LONDON SECTION. Short Papers by London Section Members. *Dyeing of Ribbons.* R. C. Oakley, Esq. and *Dyeing of Carpet Yarns.* R. Woods, Esq., F.S.D.C. Royal Society, Burlington House, **London W.1.** 6 p.m.

Tuesday, 8th December 1959

SCOTTISH JUNIOR BRANCH. *Heat Setting.* J. A. Bamber, Esq. (British Rayon Research Association). Technical College, **Paisley.** 7.30 p.m.

Wednesday, 9th December 1959

BRADFORD JUNIOR BRANCH. Annual Dance. Betty's Cafe, **Bradford.**

Thursday, 10th December 1959

WEST RIDING SECTION. *The Kinetics of Wool Dyeing with 2,1 Metal Complexes.* Dr. H. Ackermann (Geigy, Basle). Victoria Hotel, Bridge Street, **Bradford 1.** 7.30 p.m.

MANCHESTER JUNIOR BRANCH. *Modern Techniques in Vat Dyeing.* L. Boardman, Esq., A.R.C.T., Room J/B 16, Chemical Engineering Building (Jackson Street), College of Science and Technology, **Manchester.** 4.30 p.m.

Tuesday, 15th December 1959

HUDDERSFIELD SECTION. *The Colouring of Tufted Carpet in Piece Form.* R. C. Cheetham Esq., G. W. Lewis, Esq. and Dr. J. Waller. (Courtaulds Ltd., Droylsden). Silvios Cafe, Westgate, **Huddersfield.** 7.30 p.m.

SCOTTISH SECTION. *The Principles of Colour Photography.* Dr. C. H. Giles (on behalf of Ilford Ltd.). St. Enoch Hotel, **Glasgow.** 7.15 p.m.

NORTHERN IRELAND SECTION. *The Mechanism of Dyeing with Procion Dyes.* H. H. Sumner, Esq., B.Sc. (Imperial Chemical Industries Ltd.). Grosvenor Rooms, **Belfast.** 7.30 p.m.

Wednesday, 16th December 1959

BRADFORD JUNIOR BRANCH. *Recent Developments in Wool Dyeing.* D. G. Evans, Esq. (CIBA Clayton Ltd.) Institute of Technology, **Bradford.** 7.15 p.m.

MIDLANDS SECTION. *Acrylics in Knitwear.* Half Day Symposium. J. F. Gaunt, Esq., Ph.D., F.R.I.C., F.T.I., H. D. Edwards, Esq., Ph.D., A.R.I.C., J. Rayment, Esq., A.T.I. College of Technology, **Loughborough.** 2.30 p.m. and 7 p.m.

January 1960

SCOTTISH JUNIOR BRANCH. The date and title of this lecture is to be arranged.

Friday, 8th January 1960

LONDON SECTION. *New Works on the Dyeing of Nylon with Disperse Dyes.* H. W. Seaman, Esq., B.A. (I.C.I. Ltd.). Royal Society, Burlington House, **London W.1.** 6 p.m.

Tuesday, 12th January 1960

NORTHERN IRELAND SECTION. *Radio-isotopes and Their Industrial Applications.* R. J. Magee, Esq., M.Sc., Ph.D., M.R.S.A., A.R.I.C. (Queen's University, Belfast). Grosvenor Rooms, **Belfast.** 7.30 p.m.

Thursday, 14th January 1960

WEST RIDING SECTION. *Experience gained in the Dyeing and Finishing of Polyester/Wool Fabrics in Germany.* Dr. J. Nusslein (Farbwerke Hoechst). Victoria Hotel, Bridge Street, **Bradford 1.** 7.30 p.m.

MANCHESTER JUNIOR BRANCH. *A Survey of Modern Textile Finishing.* G. Landells, Esq., B.Sc., Ph.D., A.R.I.C., F.S.D.C. Room J/B 16, Chemical Engineering Building (Jackson Street), College of Science and Technology, **Manchester.** 4.30 p.m.

Monday, 18th January 1960

BRADFORD JUNIOR BRANCH. *Problems in the dyeing of Wool, Fibro and Terylene for blending.* Miss Esmée Smith (Wm. Smith & Co. Ltd.) Institute of Technology, **Bradford.** 7.15 p.m.

Tuesday, 19th January 1960

MIDLANDS SECTION. *Beam Dyeing.* (Paper written by Burlington Corp. U.S.A.) K. S. Laurie, Esq. A.M.I.Mech.E., A.M.I.E.E. Gas Theatre, **Nottingham.** 7 p.m.

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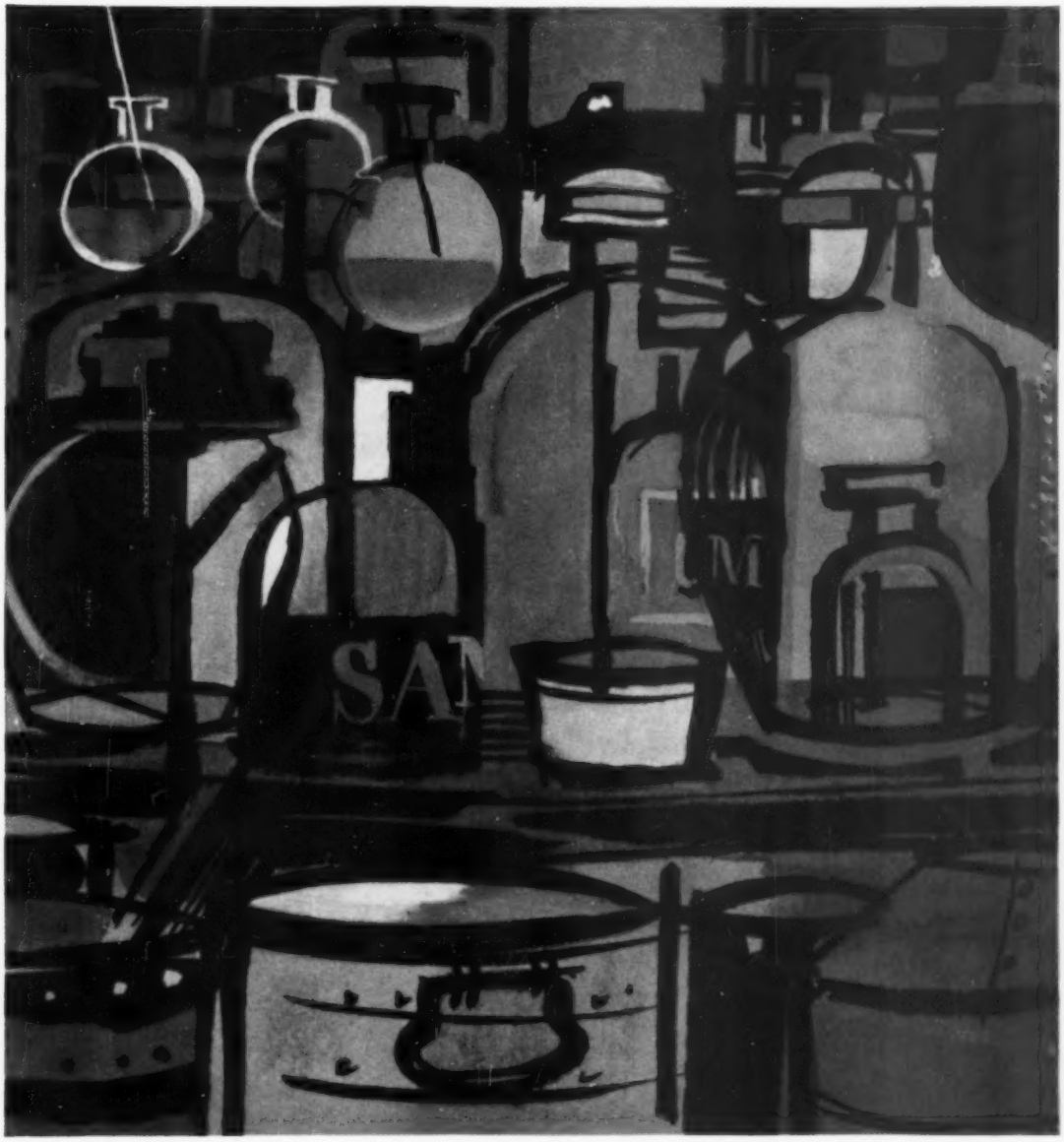

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THE JOURNAL
OF THE
Society of Dyers and Colourists

Volume 75 Number 9 SEPTEMBER 1959* Issued Monthly

Proceedings of the Society

Stenter Drying

T. A. Uthwatt and J. S. Woollatt

Meetings of the Northern Ireland Section held in the Grosvenor Rooms, Belfast, on 10th March 1959, Mr. W. J. Macnab in the chair; and of the Manchester Section held at the Textile Institute, Manchester, on 17th April 1959, Mr. H. A. Turner in the chair

Stenter drying by forced convection is discussed. The physical laws and the limitations which they impose are detailed. The factors which affect evaporative capacity are divided into those beyond and those within the designers' and operators' control. The methods used to develop a new design of stenter are described.

Introduction

So much has been written and said about stenter drying in the last few years that it is difficult in a short lecture to cover much new ground. However, since some of the views that have been expressed are contradictory, it is perhaps worth while considering them again.

This lecture deals only with the thermodynamic aspects of stenter operation, i.e. with the heating and the drying. The mechanical aspects would require separate treatment.

It is fully appreciated that the requirements for maximum thermal efficiency may conflict with those for maximum convenience and for the best finish or handle, but it is only by a thorough understanding of all these requirements that the best compromise will be reached.

Before considering stenter conditions it is worth while mentioning the financial savings which may be obtained by taking advantage of recent developments. The extent of such savings may be as great as 20d. per 100 yd., viz. 40d. per 100 yd. for cloth dried on a machine installed in 1930, and 20d. per 100 yd. for a machine installed in 1959. These figures take into account the depreciation and interest on the money required to purchase the new machine, while assuming that the cost of the older machine has been completely written down. Their derivation is given in Table I. The increased labour cost in the 1959 stenter is due to the extra labour required to handle the extra cloth between the stenter and preceding and following machines.

Stenter drying nevertheless remains an, if not the most, expensive method of drying in the textile industry. It should therefore be used only when no other method is possible. The type of finish required normally determines when it is necessary. Alternative means of moisture removal, such as mangling, hydroextracting, centrifuging, and drying on cylinders, should always be considered. For cloth in open width the obvious alternatives are mangling, hydroextracting, and cylinder drying. Mechanical methods, viz. mangling and hydroextraction, are undoubtedly the cheapest, although the expression obtained is limited. For a given evaporative capacity, cylinders are considerably cheaper in initial cost, and slightly cheaper in running cost, than a stenter. For maximum economy, therefore, the cloth should pass through an efficient mangle or hydroextractor and over some drying cylinders before entering the stenter. Since, however, the cloth must remain plastic to undergo any dimensional changes which are required on the stenter,

Table I

Comparative Cost of Stenter Drying

Date of installation	1930	1945	1959
Length of enclosure, ft.	60	60	40
Evaporation rate, lb./sq.ft. per hr.	1·5	2·5	8
Ratio of steam condensed : water evaporated	4·5	2·5	1·75
Cloth speed, yd./min.	25	41	88
Capital cost, £/yr.			
Depreciation	—	—	3350
Interest on capital	—	—	920
Running cost, £/yr.			
Labour	2900	2900	3500
Steam	5050	3750	7000
Electricity	2500	2500	3500
Maintenance	500	500	300
Cost per 100 yd., d.	39·4	21·6	18·8

* Published October 1959

the use of cylinders is limited. It is generally assumed that cotton cloth, for example, remains plastic until the moisture content falls to about 20%. To allow a margin of safety it is normal practice for the cloth to enter the stenter with a moisture content of about 40%.

There are undoubtedly certain disadvantages in using drying cylinders. As well as additional mechanical complications there are the more important effects of stoppages. The portion of cloth which remains too long on the cylinders may be too dry when it enters the stenter. Furthermore, certain finishes are affected by contact with cylinders. Thus, despite the economic advantages, there are obviously certain circumstances in which drying cylinders are undesirable, and in which the extra expense of drying the cloth on a stenter only is justified.

Physical Laws and Limitations

Before the factors which affect the output of a stenter can be appreciated, it is essential to understand the underlying physical laws and the limitations which they impose.

Cloth is dried by the evaporation of moisture, which is effected by conveying heat to the cloth by conduction, convection, or radiation.

Conduction is used in drying cylinders, but not in stenters.

Radiation is used in stenters, but so far with limited success, primarily, it seems, because of the cost: radiant heat is most simply obtained by the use of specially designed electric heaters, but electricity represents an expensive form of heat compared with steam, and unless the extra expense is recovered elsewhere, electric heaters tend to be uneconomic. The extra expense is occasionally warranted, however, but only when steam is not available. An obvious example is in the setting of nylon, Terylene, etc., requiring temperatures of the order of 400–450°F., which are seldom obtainable with steam. For this purpose, radiant heaters appear to be meeting with considerable success.

Convection remains the method of heat transfer normally used in stenters, and the rest of this paper deals exclusively with stenters of this type.

As the wet cloth is heated, a point is reached at which the vapour pressure of the liquid contained in the cloth is equal to the partial pressure of the moisture in the surrounding atmosphere. This occurs when the cloth temperature reaches the dew-point temperature of the atmosphere. Because, however, of the difficulty of removing the moisture from the cloth through the boundary or stagnant layer, a slightly higher temperature (equal to the wet-bulb temperature) is required to cause significant evaporation. When the wet-bulb temperature is reached, evaporation proceeds at the rate at which heat can be absorbed. The cloth temperature remains equal to the wet-bulb temperature, or slightly above if the rate of evaporation is high, until the moisture content of the cloth approaches the natural regain. Evaporation then continues at a lower rate, and the cloth temperature rises. The reason for this can well be understood if consideration is given to the ways in which moisture is retained in the cloth. Some is mechanically trapped between threads, some mechanically trapped between individual hairs, some absorbed by the hairs, and finally some is chemically combined with the cellulose. Moisture which is mechanically trapped is comparatively easily removed. That which is absorbed in the hairs, however, is rather more difficult to remove, and the removal of that which is chemically combined requires both the latent heat of evaporation and also the heat necessary to split the compound.

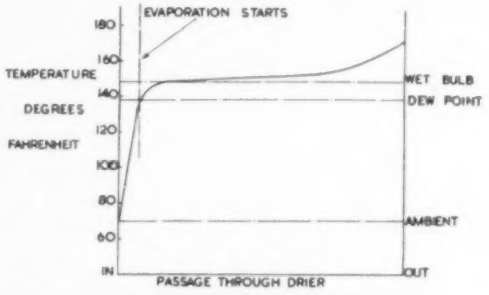


FIG. 1—Cloth Temperature during Passage through Drier (air at 300°F. containing 1000 grains of moisture per lb. of dry air)

The change in cloth temperature as it passes through a stenter is shown in Fig. 1. It will be seen that the temperature rises rapidly to the dew-point. It then rises slowly to the wet-bulb temperature, and slightly above, after which it remains constant until the cloth is nearly dry.

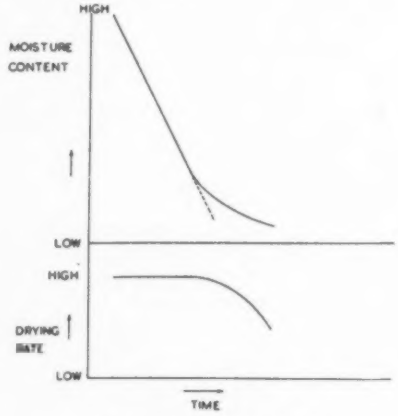


FIG. 2—Typical Drying Curve

A typical drying curve is shown in Fig. 2. There is a constant rate of drying down to some 20–30% moisture content, and thereafter a falling rate. The shape of the curve, and in particular the point at which the drying rate starts to fall off, depends upon the cloth, particularly on its fibre and construction, and indeed on the drying rate. At high rates of drying the later stages are retarded by the difficulty of freeing the absorbed moisture. With a slower rate of drying this difficulty is not so

pronounced, and both curves are somewhat straighter.

It is obvious that to obtain a high rate of evaporation the heat available in the stenter atmosphere must be conveyed to the cloth at a high rate. The rate of heat transfer from the stenter atmosphere to the cloth is dependent upon two major conditions — the temperature difference between the stenter atmosphere and the cloth, and the resistance to heat transfer between the two.

Considerations of convenience largely determine the temperature both of the stenter atmosphere and of the cloth. For reasons of economy it is normal to use steam as the heating medium, and few finishing works have boilers working at pressures greater than 120–150 lb./sq.in. This limits the dry-bulb temperature of the atmosphere to about 300–330°F. As will be seen later, considerations of efficiency dictate that the stenter atmosphere be kept as humid as possible, with a cloth temperature of 150–160°F. Little, therefore, can be done to effect an increase in temperature difference.

On the other hand, a considerable reduction in the resistance to heat transfer from the stenter atmosphere to the cloth can be effected in the arrangement of the nozzles and the air movement. The major resistance to the transfer of heat is a stagnant boundary layer which is always present at the cloth surface. Its presence may be detected by using a flattened hypodermic needle as a total-head Pitot tube. In order to obtain high rates of heat transfer it is necessary to reduce the thickness of this layer to a minimum. It has been found that this can be done by using an appropriate design and arrangement of nozzles, and by circulating large quantities of air with a high nozzle velocity.

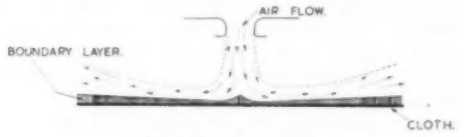


FIG. 3— Nozzle Turbulence

In order to obtain these conditions, it is imperative to have the flow of air perpendicular to the cloth, as shown in Fig. 3. This diagram indicates also the position of the stagnant boundary layer, and its probable shape, about which it is difficult to be certain, because the layer is only a few thousandths of an inch thick, and can be measured only with considerable difficulty.

Factors affecting Evaporative Capacity

The various factors known to affect the evaporative capacity of a stenter may be divided into two categories, those beyond control, and those within control. Among the former the most important are—

(1) Type of fibre
(2) Cloth weight
(3) Cloth construction
(4) Presence of a finishing agent;

and among the latter the following—

(5) Arrangement of the nozzles, i.e. their type, their layout, and their distance from the cloth
(6) Volume of air circulated
(7) Air velocity
(8) Humidity in the enclosure
(9) Drying range.

There is comparatively little information available on the effect of any of the former variables except cloth weight. The demands of trade, not the ease of stenter drying, dictate requirements. All types and conditions of cloth have to be dried. Whilst an investigation into the effect of these variables would be of academic interest, it would be most unlikely to lead to any results which would affect stenter design or performance.

On the other hand, much is known about the effects of the latter group of variables, since a proper understanding of them can improve stenter performance significantly.

1. FIBRE

It is known that certain fibres are easier to dry than others: Terylene, for example, is much easier to dry than cotton. Admittedly, this is an extreme example, since Terylene absorbs virtually no moisture into the fibre, and therefore only mechanically held water has to be removed.

2 and 3. WEIGHT AND CONSTRUCTION

In cloths woven from a given fibre, weight plays a very important part. The effect of this is shown in Fig. 4, which gives the relative overall drying rates for cloths dried between moisture regains of 70 and 5% with a particular set of drying conditions for various weights of bleached cotton plain cloth.

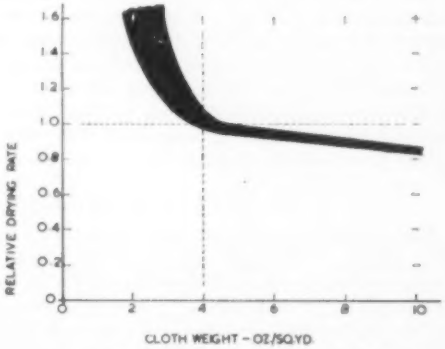


FIG. 4— Effect of Cloth Weight on Drying Rate

It will be noted that the rate for a 3-oz. cloth may be anything from 2 to 50% greater than that for a 4-oz. cloth. It will be noted also that the curve is not a single line but a wide band, particularly for the lighter weights. This is due to the different construction of the cloths. It is clear that a cloth tightly woven from thin thread presents a greater problem than a loosely spun, open-weave cloth of similar weight.

4. FINISHING AGENT

Any size or resin finish which may be incorporated in the cloth before stentering will clearly have some effect upon the drying rate, usually reducing the rate as compared with that of free water from a pure fibre.

5. NOZZLES

There can be no doubt that the arrangement of the nozzles does have a very considerable effect on the rate of transfer of heat to the cloth, because of its effect on the stagnant boundary layer. It is almost impossible to predict from theoretical considerations which is the best arrangement, or even which of two alternatives is the better. A considerable amount of development work is necessary, with a good deal of trial and error, before it is certain that the arrangement adopted is the most efficient and economical. Two obvious considerations that should be met by any arrangement are that drying should be even over the whole cloth width, and that the air issuing from the nozzles should have a free path to return to the fan inlet.

It has been suggested in some quarters [1, 2] that a considerable advantage can be obtained by placing the nozzles close to the cloth, even at distances of less than 1 in., but in the authors' experience such small distances are not advantageous. It is difficult to be definite about this matter, since the optimum distance varies greatly according to the type of nozzle. With one design a distance of 2–3 in. from the cloth is found to give the best performance. This distance is obviously convenient, since most stenter rails are at least 4 in. deep, which means that the nozzles must be at least 2 in. from the cloth if a simple nozzle arrangement is used. Telescopic nozzles between the rails have been tried, but without much success, largely because the adjacent parts are necessarily in close sliding contact and may seize because of foreign matter, lint, and particularly resin finishes, which may be polymerised. Considerations of simplicity and reliability alone thus dictate that the nozzle should not be closer than 2 in. to the cloth, but with a suitable nozzle arrangement this does not appear to reduce the evaporative capacity.

6 and 7. AIR VOLUME AND VELOCITY

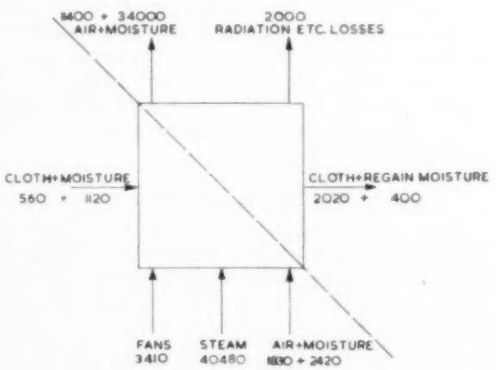
The volume of air circulated and the velocity with which it impinges on the cloth are largely interdependent. In a production stenter it is not possible to vary one without the other, and even in an experimental machine it is somewhat difficult, and often expensive. An increase in either will improve the rate of heat transfer to the cloth by reducing the average resistance. An increase in volume without an increase in velocity is obtained by using larger nozzles, and the shallowest part of the stagnant boundary layer, while remaining the same thickness, extends over a wider area. An increase in velocity without an increase in volume is obtained by using smaller nozzles, and the depth of the stagnant layer is slightly reduced. Tests conducted by the authors indicate that a more marked improvement in drying rate is obtained by an increase in velocity than by an increase in volume. On the other hand, work done by the Shirley Institute with a rather different type of nozzle indicates that there is little to choose between an increase in velocity and an increase in volume. Thus their relative effect obviously depends upon the nozzle arrangement being tested.

There are advantages in increasing the volume rather than the velocity of the air. The fan power required to double the volume, keeping the velocity constant, is rather more than double, whereas to double the velocity, keeping the volume constant, requires rather more than treble the power. Moreover, with higher velocities care must be taken to avoid mechanical damage to the cloth from flutter and similar conditions. Correct nozzle design will, however, obviate flutter, even with nozzle velocities of 9,000 ft./min. or above.

The optimum conditions of velocity and volume circulated thus depend upon the nozzle arrangement. It is not possible to lay down any hard and fast rule which applies to all stenters.

8. HUMIDITY

This affects both evaporative capacity and efficiency. As already stated, the evaporative capacity is proportional to the difference between the wet- and dry-bulb temperature in the enclosure, and can be improved by increasing the difference between them. The dry-bulb temperature is usually determined by the steam pressure available, and cannot normally be increased. The wet-bulb temperature can be reduced by increasing the intake of fresh air, but this unfortunately increases also the ratio of steam condensed to water evaporated, and therefore makes the unit less efficient. This point is perhaps best understood by considering the heat balance in a normal stenter. The example chosen (see Fig. 5) is a typical 1959 stenter, having four sections each 10 ft. long, and drying 4-oz. cotton cloth 60 in. wide at a rate of 88 yd./min. from 80% to 8% moisture content. Steam pressure of 120 lb./sq.in. gauge is assumed, and a humidity in the enclosure of 1,000 grains per lb. of dry air.



40 FT. ENCLOSURE, 4 OZ. CLOTH 60 IN. WIDE RUNNING AT 88 YARDS PER MINUTE, DRYING RANGE 80% TO 8%

FIG. 5— Thermal Balance (B.T.U./min. per section)

The heat is supplied from the steam condensed and by the power absorbed by the air from the fan. The heat is absorbed by—

(*a*) The cloth with regain moisture, which is hotter when it leaves than when it enters

(*b*) The evaporation of water, requiring sensible, latent, and super-heat

(*c*) Radiation from the external surfaces of the enclosure

(*d*) Heating of the fresh air introduced.

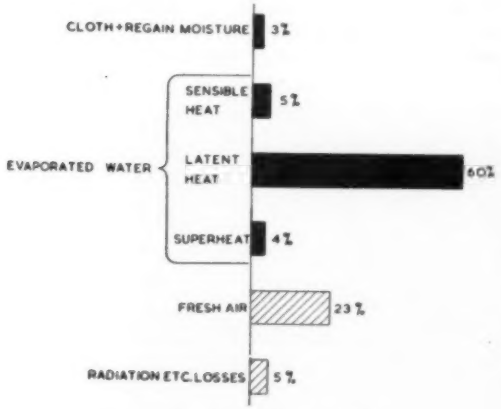


FIG. 6—Distribution of Heat absorbed

The proportions of heat absorbed in these various ways in this particular example are indicated in Fig. 6. The black areas represent the heat that must be supplied in evaporative drying. There is nothing the designer or the operator can do to vary this amount significantly. The shaded areas, i.e. fresh air and radiation losses, can be controlled. Radiation losses represent only a small proportion, so that even a dramatic reduction could not affect the overall position noticeably. Nevertheless, it is well worth while to ensure that the enclosure is efficiently lagged. This problem has been most adequately covered in a paper by Thomas [3]. This leaves only the fresh-air intake, which for most efficient operation should be kept as low as possible. This, however, reduces the rate of evaporation, as indicated in Fig. 7, and hence the capacity of the unit.

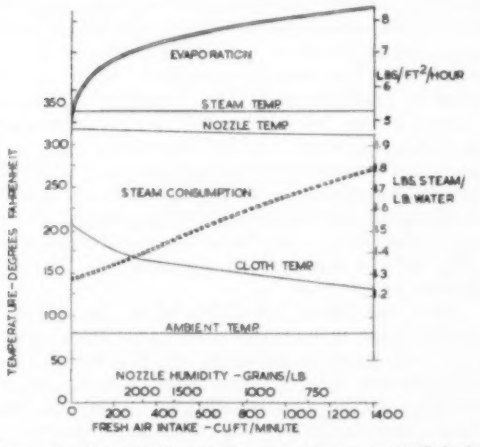


FIG. 7—Conditions in Stenter Enclosure—Steam at 100 lb./sq.in.

It is virtually impossible to operate conveniently at high humidities. However well the enclosure is made, there are bound to be leaks at the cloth entry and exit, and the enclosure itself is never quite leak-free. A figure of 1,000 grains of moisture per lb. of dry air is a good working figure, although slightly higher figures of humidity may be obtained by taking very special precautions.

Here it would be as well to say something about the effect of superheated steam. So far the circulated fluid has been loosely described as "air"; it is in fact a mixture of air and superheated steam. Even atmospheric air is such a mixture, although it is more normal to regard it as air and water vapour. The latter is, however, only steam at a low partial pressure, the proportion of steam present and the amount of superheat being dependent upon the relative humidity.

In modern stenters with a high degree of recirculation, the proportion of superheated steam is greater than in old machines in which there is no recirculation. Theoretically, it would be possible to operate a stenter with an enclosure containing only superheated steam, since this is generated in the enclosure by the evaporated moisture. In practice, however, this is virtually impossible, because of the fresh air brought in by the cloth and clips. In fact, with forced convection drying, superheated steam has much the same evaporative capacity as air. Steam is rather lighter, but its heat-transfer coefficient is about 50% greater. These factors cancel each other out, giving the two media similar capacities [4].

There seems no justification for the view that superheated steam is a more powerful drying medium than a mixture of it with air. With superheated steam only, the cloth temperature would be 212°F., and the dry-bulb temperature, say, 310°F. With a normal influx of fresh air these temperatures would be, say, 150°F. and 300°F. respectively, giving a considerable increase in evaporative capacity.

It is clear from Fig. 7 that a reduction in fresh-air intake reduces both the steam consumption and the rate of evaporation. The volume of fresh-air intake is most conveniently assessed by measuring the humidity in the enclosure, and it is frequently assumed that high humidities are synonymous with high efficiencies. This is true only if the high humidity indicates a low fresh-air intake. Thus, thermodynamically no useful purpose is served by creating a high humidity by discharging steam from open pipes into the enclosure. This increases the humidity without noticeably reducing the fresh-air intake, and thus reduces only the evaporation, not the steam consumption. This last, indeed, may even be increased by the steam used to generate the internal humidity.

9. DRYING RANGE

Varying the entering and leaving moisture content may affect the evaporative rate significantly. Work at the Shirley Institute[5] has indicated that varying the terminal moisture content from 8% to 2% may reduce the evaporative capacity by as much as 11%.

Development

The theory of stenter drying broadly outlined in the first part of this paper forms a useful foundation for the research and experimental work necessary for the development of any new stenter design. Because of the variability of many of the interrelated physical factors, it presents no ready-made answers to the design problems which arise: it does, however, provide a set of principles which forms a framework within which experiments may be usefully conducted.

Questions which the theory can help to solve may include the desirability of a higher drying speed, the practicability of achieving it, and the significance of any effects it may have; the advisability of employing increased volume or increased velocity to achieve a higher drying rate; the practical upper limits of fan power; and the development of a suitable ventilating system making use of extraction fans, which will achieve a satisfactory compromise between drying rate and thermal efficiency.

The experimental work necessary for the solution of problems such as these is itself beset with difficulties, foremost among which is the reproduction and maintenance of steady operational conditions. Some considerable time is necessary for conditions in a full-scale drying section to become sufficiently stable for valid test results to be obtained, and minor variations in conditions, such as a slight fluctuation in steam supply, can easily ruin an experiment. The use of model driers, a typical example of which is illustrated in Fig. 8, has been found to be the best solution to this problem.

The design of this apparatus is such that conditions of temperature and humidity can be easily established and kept constant at the desired values, and all necessary measuring and recording instruments have been incorporated. The nozzles and internal partitions are readily accessible and may be varied simply and quickly.

The apparatus is designed to dry small samples of cloth on a pin frame, to dry long lengths, or for the continuous drying of a loop of material returned over the top of the machine on rollers.

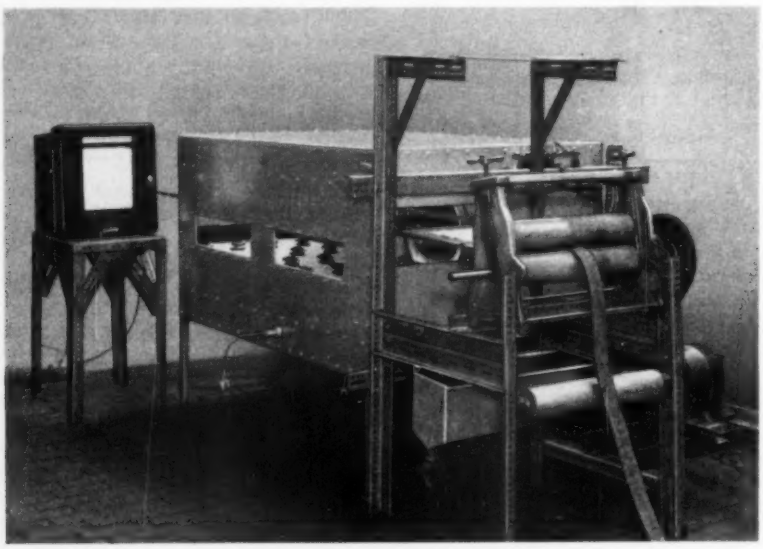


FIG. 8

On an experimental machine the cost of running is of minor importance, and electrical heating is used. This, together with the small size of the enclosure, enables steady conditions to be obtained much more simply than with a production machine. The results obtained have enabled reliable predictions of the capacity of full-size machines to be made. This is particularly important, since it enables the model drier to be used in determining the evaporative capacity of a production stenter, and it may thus be used for deciding the size of stenter enclosure required for a particular duty. In view of the unpredictable effect of the many cloth variables this is of the utmost importance.

Once the broad principles of a new design of stenter have been established by practical experiment, the problem becomes one of detailed design of enclosure, fans, heaters, ducting, and nozzles to produce the required conditions. There are three basic arrangements of ducting, which are illustrated in Fig. 9. The choice of layout is

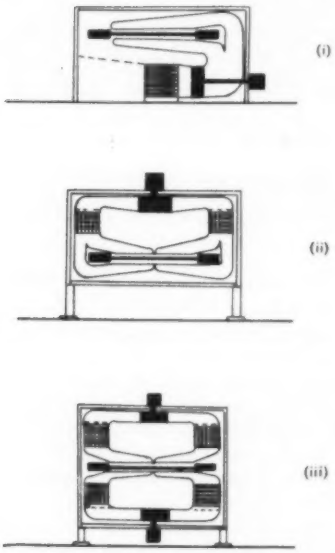


FIG. 9—Types of Heating Arrangement

influenced by such considerations as compactness, the necessity for even drying, and the relative expense of single and multiple heater and fan arrangements. Type (i) is the most simple and compact, but suffers from being unsymmetrical, with the result that it is difficult to ensure even drying over the width. One side of the stenter rail is inaccessible unless special arrangements for easy ducting removal are made. Such arrangements might permit air leaks, with a resultant loss of evaporative capacity. Type (ii) is symmetrical horizontally, but the path for air returning to the fans is complicated, with a consequent increase in fan power and a possible increase in radiation losses. Both rails are inaccessible. Type (iii) is both symmetrical and accessible, but because of the multiplicity of heaters and fans it is expensive compared with the other two.

Modern stenters circulate large volumes of air through confined ducting, which, unless it is aerodynamically sound, may cause excessive frictional loss. Such a loss reduces the nozzle velocity available from a given fan and thereby reduces the evaporative capacity. Although much can be achieved by an understanding of aerodynamics, this does not entirely replace practical tests. Such work calls for very close collaboration between designer and experimental staff.

Once the design has been completed, a prototype section is built and tested. Minor modifications may be required to meet the desired specification, after which a production machine is built. Once installed, this is given a very thorough test to prove that all design conditions are met. This test requires much more attention than a routine capacity and efficiency test. Temperature measurements are made at numerous points to prove the efficiency of the heaters. Velocity measurements are made to prove the fans and ducting.

In undertaking these tests and, indeed, routine capacity and efficiency tests, large quantities of similar cloth are required. Sufficient time must be allowed for conditions in the enclosure to become stabilised before the test begins. This may require 20–45 min. To obtain reliable figures, the test itself should last for a further 30–45 min. With modern high-speed machines this may call for 5,000–10,000 yd. of cloth. If this is not available, the same cloth may be reprocessed.

The figures obtained from such results are invaluable in indicating the correctness of the forecast from laboratory tests and in guiding the design of future production models.

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COMMUNICATIONS

Some Observations on Dyeing by the Cuprous-ion Method

D. R. GRAHAM and K. W. STATHAM

The addition of complexing agents, such as chloride ions, has been shown to produce a more even uptake of cuprous ions by Orlon. The shrinkage of acrylic fibres during dyeing by the cuprous-ion method appears to depend on the amount of copper adsorbed. It may be due to disorientation of the molecular structure of the fibre.

Orlon can be dyed with selected acid and direct dyes in the presence of cuprous ions [1].

The uptake of cuprous ions from solution by Orlon is very rapid. Because of this, and the instability of cuprous compounds in aqueous solution, it is usual to produce the cuprous ions at a relatively slow rate by the reduction of cupric salts. The most promising reducing agents appear to be hydroxylamine sulphate [2], sodium bisulphite (alone or with glyoxal) [3], and metallic copper [4]. The process using metallic copper has been patented by Sandoz Ltd. and is known as the Sandocryl process.

In the case of reducing agents such as hydroxylamine sulphate, the rate of reduction of cupric salts to the cuprous state is rapid, and if all of the reducing agent is added initially, the concentration of cuprous ion becomes large enough to cause trouble in the levelness of the dyeing and may cause precipitation of metallic copper on the fibre [2]. To overcome this, it has been suggested that the reducing agent should be added in several portions during the dyeing or alternatively added by a drip-feed technique [5, 6]. The Sandocryl process, however, does not suffer from this defect, but even so we have found that the production of cuprous ions is still rapid enough to cause unlevelness, particularly on yarn dyed in the Hussong machine.

In theory it should be possible to reduce the concentration of free cuprous ions in the solution by the addition of complexing agents to the liquor. In addition to reducing the concentration, the complexing agent will also stabilise the cuprous ion against hydrolysis to cuprous oxide, disproportionation to cupric salt and metallic copper, and also oxidation to cupric salt.

Preliminary experiments showed that chloride and bromide ions, which can form complexes such as $CuCl_2^-$, gave more level uptake of cuprous ions by Orlon. The use in the dyeing of Orlon of cuprous complexes of nitriles, such as malonodinitrile, has recently been described [7].

Experimental Methods and Results

1. MATERIALS

The Orlon used in these experiments was a sample of high-bulk Orlon 42 knitted into circular jersey fabric. The material was scoured in a non-ionic detergent before use.

The dyes used were ordinary commercial dyes, and the chemicals were of B.P. or similar quality.

Unless stated otherwise, all quantities are expressed as percentages on the weight of the acrylic fibre.

2. USE OF COMPLEXING AGENTS TO PROMOTE EVEN UPTAKE OF CUPROUS IONS BY ORLON

These experiments were carried out on 5-in. squares of Orlon fabric. A glass stirrer with a hooked end was sewn to the centre of the square, and the fabric stirred in the liquor at about 100 r.p.m. All experiments were carried out at a liquor ratio of 40 : 1, unless stated otherwise.

The general experimental conditions used were as follows—

5 g. Copper mesh (24 gauge) per litre of solution
1% Solway Ultra Blue B (C.I. Acid Blue 25)
1% Copper sulphate (hydrated)
Sulphuric acid to give pH 2.

The bath was made up with the acid, dye, and copper mesh. The fabric was then entered into the liquor, and the temperature raised to 85°C. as quickly as possible. The copper sulphate, previously dissolved in a little water, was added, and the bath raised to the boil. The time of boiling was 1 hr.

It was found that, in the absence of complexing agents, there was a central circle, about 1 in. in diameter, of undyed Orlon surrounded by a larger area of unevenly dyed material; whereas in the presence of complexing agents there was only a very small patch of undyed or unevenly dyed material. In some cases the complexing agent combined too firmly with the cuprous ions, and very little dyeing took place.

The effects of various anions on the levelness and the rate of dyeing, using 10% of the sodium or potassium salt, are given in Table I.

TABLE I

Effect of Anions on Levelness of Cuprous-ion Dyeings

	Anion	Levelness	Rate of Dyeing
(1)	—	Unlevel	Rapid
(2)	Nitrate	Unlevel	Slightly slower than (1)
(3)	Sulphate	Unlevel	Slightly slower than (1)
(4)	Fluoride	Very unlevel	Rapid
(5)	Phosphate	Very unlevel	Rapid
(6)	Chloride	Slightly unlevel	Slightly slower than (2)
(7)	Bromide	Slightly unlevel	Slightly slower than (2)
(8)	Thiocyanate	Level	Very slow

These results show that only those anions which are known to form complex ions with cuprous ions have any effect on the levelness of the dyeings. Although the rate of dyeing in the presence of sodium chloride was slower than in the control

experiment, the exhaustion after 1 hr. at the boil was still good, as is shown by the results in Table II.

TABLE II

Exhaustion of Dyeings in the Presence of Various Salts

Added Salt (10%)	Exhaustion after 1 hr. (%)
None	99
10% NaCl	90
10% Na_2SO_4	98
10% $NaNO_3$	97

An alternative method of showing the levelness of dyeings in the presence of chloride ions was to have the fabric loose in the dyebath and the copper metal in a glass tube open at both ends, but of such length and diameter that the copper could not come into contact with the Orlon. In these experiments the fabric was evenly dyed in the presence of chloride ions, but very unevenly in their absence.

It was found that approx. 7–8% sodium chloride on the weight of the Orlon was required to give level dyeings.

It was found also that, if Orlon was dyed on a stirrer by the cuprous ion method using hydroxylamine sulphate as reducing agent, more level dyeings were obtained in the presence of chloride or bromide ions than in their absence.

Cuprous copper forms complex ions with thioamides such as thiourea, and it is to be expected, therefore, that these compounds will improve the levelness of the cuprous ion dyeing of Orlon. With the copper metal in a glass tube, more level dyeings were obtained in the presence of small amounts (0·5–1·0%) of thiourea and ethylenethiourea than in their absence. The effect was not so marked as with chloride ions, and at higher concentrations of thioamide there was a tendency to form blackish spots (presumably of cupric sulphide).

Previous work has shown that the presence of chlorides is undesirable because of the retarding effect on the rate of dyeing [2, 8]. This retarding effect is not of great importance with many dyes, but with others the effect is very marked. In these cases the beneficial effect of chlorides in promoting level dyeing could be obtained by precoppering the Orlon in the presence of chloride ions and then dyeing in a separate liquor.

When the process is carried out in this way, much heavier dyeings could be obtained on Orlon precoppered in the presence of chloride ions. It was, however, advisable to leave the copper metal in the solution during dyeing, as this prevented the dye from bleeding from the Orlon on prolonged boiling. This loss of dye on boiling in the absence of copper metal is probably due to the setting-up of an equilibrium between the copper–Orlon complex and cuprous ions—

$$\text{Orlon–Cu}^{+} \rightarrow \text{Orlon} + \text{Cu}^{+}$$

followed by loss of cuprous ions by oxidation, disproportionation, etc. In the presence of copper metal, however, the loss of cuprous ions is largely prevented.

The above results were obtained on Orlon acrylic fibre. It was not possible, however, to show the beneficial effect of chloride ions on the cuprous-ion dyeing of Acrilan, as this fibre has good affinity for acid dyes without the use of this method of dyeing.

At the time this work was carried out it was possible to obtain most colours on Orlon using basic or disperse dyes, and in general the dyeings had good fastness to light and to washing. In the case of black, however, the only dyeings of high fastness to light (5 or better) were obtained by the cuprous ion method.

We found that by precoppering the Orlon in the presence of chloride ions and then dyeing black using—

6·4% Solway Ultra Blue B (C.I. Acid Blue 25)
2·0% Naphthalene Red J (C.I. Acid Red 88)
1·45% Metanil Yellow YK (C.I. Acid Yellow 36)

it was possible to reduce the total dyeing time and to use less copper sulphate than when the dyeing was carried out using the hydroxylamine or Sandocryl methods.

Although the quality of the dyeing was satisfactory, the Orlon had shrunk considerably during dyeing. This shrinkage was in addition to the "bulking" shrinkage. Orlon fabric dyed in this way handled like heavily felted wool fabric. In view of the quicker, less expensive, and more level dyeings obtained by this method, it was decided to investigate the cause of this extra shrinkage, to see whether it could be eliminated.

3. EXTRA SHRINKAGE OF ORLON

Preliminary experiments showed that this extra shrinkage of Orlon was a special feature of the cuprous-ion dyeing method and was not caused by boiling in the presence of salt. The shrinkage of Orlon precoppered in the presence of salt was roughly proportional to the amount of copper sulphate used. This extra shrinkage was not confined to cuprous-ion dyeing in the presence of salt, but occurred also in the absence of salt (e.g. in the normal Sandocryl process). This suggests that the extra shrinkage is in some way connected with the adsorption of cuprous ions by the fabric. In the literature there have been a number of references to the shrinkage of Orlon during dyeing, but most of them refer to the shrinkage shown by most synthetic fibres at high temperature or to the "bulking" shrinkage. Laucius, Clarke, and Brooks [9] have reported, however, that there is some shrinkage in the dyeing of Orlon by the cuprous-ion method, particularly with heavy dyeings, and that the shrinkage depends on the copper content of the fibre, but they do not give any experimental results to support the latter statement. The following experiments were carried out to test whether this extra shrinkage of Orlon is related to the copper content of the fibre.

4. VARIATION OF ORLON SHRINKAGE WITH COPPER CONTENT

These experiments were carried out on Orlon fabric that had been preshrunk by boiling in

water for 1 hr. The reaction with copper and cupric sulphate was carried out as described for dyeing. The copper content was varied by varying the time of reaction and the concentration of copper sulphate, and by the addition of chloride or bromide ions. The area shrinkage of the fabric was determined in the usual way.

The copper content was determined by digesting 2 g. of the treated fabric with 5 ml. concentrated sulphuric acid, 2 g. potassium persulphate, and 5 ml. fuming nitric acid. Further small additions of fuming nitric acid were made until the solution was clear white or bluish green in colour (depending on the copper content). After cooling, the solution was diluted with 20–30 ml. distilled water, and boiled to destroy any nitrosylsulphuric acid present. The solution was then concentrated to about 5 ml., and 2 ml. hydrogen peroxide (35%) added to destroy any organic matter present. (In some cases, when this step was omitted, only part of the copper appeared to be free to react with potassium iodide, the remainder probably being complexed with e.g. polyacrylonitrile of low molecular weight.) The excess peroxide was destroyed by diluting and boiling the solution. The solution was then transferred to a 250-ml. conical flask, and sufficient concentrated ammonia added to give a deep blue colour. Glacial acetic acid (5 ml.) was then added, and the solution cooled before addition of 2 g. potassium iodide. The liberated iodine was titrated with 0·1 N. sodium thiosulphate.

The results obtained are summarised in Fig. 1.

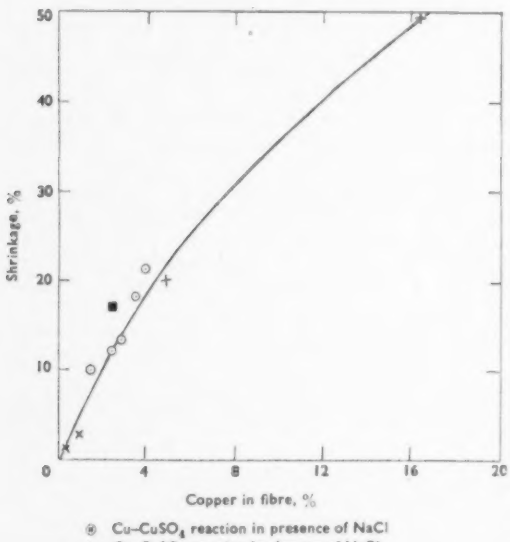

FIG. 1—Effect of Copper Content on Shrinkage of Orlon

Although the extra shrinkage of Orlon is related to the copper content of the fibre, the adsorption of dyes by coppered Orlon increased this shrinkage.

Thus prebulked Orlon, boiled with 20% cupric sulphate, 10% sodium chloride, 6% sulphuric acid, and 5 g. copper mesh per litre (liquor ratio 40 : 1) until the shrinkage was constant (28·9% after 7 hr.), when dyed with 10% Sandocryl Black BLC–I (S) and 2% sulphuric acid in the presence of copper mesh for 4 hr., had a total shrinkage of 38%.

In the case of Acrilan, however, less copper is taken up on boiling with cuprous chloride dissolved in hydrochloric acid, and there was little or no shrinkage. The highest copper content obtained was approx. 6%, and the shrinkage was less than 2%.

5. ADSORPTION OF SILVER IONS BY ORLON

Feild and Fremon [1] have shown that silver ions are adsorbed from solution by acrylic fibres in a similar manner to cuprous ions. When Orlon is boiled with silver nitrate in aqueous solution there is considerable discoloration of the Orlon, but in the presence of acid, e.g. sulphuric acid, only slight discoloration. There was considerable shrinkage of the Orlon fabric, and this varied with the silver content, as is shown by the results in Table III. The silver content was determined by Volhard's method after destruction of the Orlon with fuming nitric acid, as described above.

TABLE III

Variation of Shrinkage with Silver Content

Ag in Orlon (%)	Shrinkage (%)
1·4	6·8
1·6	11·2
3·2	21·5
9·4	53·0

Discussion

From the above results it can be seen that during the cuprous-ion dyeing of Orlon, particularly in the presence of chloride ions, there is, in addition to the "high-bulk" shrinkage, extra shrinkage that varies with the copper content of the Orlon.

During the manufacture of Orlon and other synthetic fibres the fibre is first produced in a comparatively disordered form, which is converted to a more orientated form by drawing. The molecular chains are then more or less parallel to the fibre axis. If the chains are then disorientated, there will be shrinkage of the fibre.

In the case of Orlon it has been suggested that the molecular chains are held together by hydrogen bonds between the nitrile groups of one chain and a hydrogen atom on a carbon atom of another chain [10]. During dyeing by the cuprous-ion method it is likely that the cuprous ion is co-ordinated with four nitrile groups. If this is so, then the nitrile groups will no longer be free to act as acceptor groups for the formation of inter-chain hydrogen bonds. In addition, the entry of the cuprous ion will tend to force apart the molecular chains, and the whole effect will be to cause partial disorientation and hence shrinkage of the fibre.

In the case of Acrilan, the regular sequence of acrylonitrile units is interrupted by the presence of basic groups, probably vinylpyridine. The presence of these groups will tend to reduce the

chance of four nitrile groups being available for co-ordination with cuprous ions, and this could account for the observation that it is more difficult to introduce cuprous ions into Acrilan than into Orlon.

* * *

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The Action of Sulphuric Acid on Wool
III—Isolation and Analysis of Three Preparations from the Wool Fibre

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Three structural components isolated from the wool fibre, two by acid treatment and one by alkali treatment, have been studied. Each treatment has been followed by specific analyses in an attempt to define the purity of the final products. Total amino-acid analyses were performed on these products when the specific analyses approached a constant value and the microscopic examination indicated that a well defined residual membrane was present.

The results clearly show that the two membranes isolated by acid treatment differ from each other, but that the third may be identical with one of these. Further, all the membranes resistant to attack have a low content of long-side-chain amino acids, and in one case an exceptionally high cystine content was found.

The isolation and analysis of the various histological components of the wool fibre has proved a difficult problem to the chemist, although many claims have been made of the isolation of membranous components.

The presence of the epicuticle was shown by several workers [1–4]. Lagermalm and Gralén [5] and their co-workers isolated a preparation from wool by sodium sulphide treatment which they claimed to be the epicuticle. The chemical nature of this component has aroused considerable controversy owing to the difficulties of isolating a pure sample.

Thus the suggestion of a polysaccharide residue in the epicuticle [5] may probably be due to impurities present in the original wool. Other structures have been suggested [6, 7], but recently Golden *et al.* [8] have reported an amino-acid analysis of the epicuticle which showed the presence of large quantities of aspartic and glutamic acids.

A previous similar analysis by Schuringa, Schooneveldt, and Ultée [9] had given results which indicated that the epicuticle was protein in nature and similar in composition to whole wool, but containing a high proportion of histidine. It is clear from the conflicting results obtained that, until a more satisfactory method is available for the isolation of the epicuticle, its chemical structure will remain unsolved.

Beneath the epicuticle is a soft, alkali-soluble component, the K1 phase or exocuticle, overlying a more resistant component, the K2 phase or endocuticle, which has a grooved surface. These two phases make up the bulk of the scaly material. Chemical analysis of these components is difficult, again because of problems of isolation. Geiger [10] analysed residual material from fibres treated with thioglycollic acid, which, he considered, left the K2 phase undissolved. The material has a high sulphur content, but Schoeberl [11] considers that the additional sulphur was introduced during isolation of the preparation. It has also been suggested that an easily stained, thin layer, resistant to both keratinolytic and enzyme digestion, is located between the epicuticle and the exocuticle [12].

The subcuticle membrane, observed by Reumuth [13] and Harrison [14], was subsequently isolated by various workers. Alexander and Earland [15, 16] used peracetic acid oxidation, followed by ammonia extraction to isolate the membrane, which was found to be chemically more stable than the remainder of the fibre. This membrane was claimed to possess an amino-acid content and an X-ray diagram both differing from those of the fibre as a whole. Gralén, Lagermalm, and Philip [17] suggested from electron-microscopic observation that this preparation was heterogeneous in nature, and this view was supported by the work of Elliott and Manogue [7]. Elliott and Roberts [18] used dichromate oxidation followed by ammonia extraction to isolate this component.

The chemical analyses for the above components are difficult to interpret, and it is doubtful whether any component can be isolated from the wool fibre without contamination by residues from others. The discrepancies, many of which are fundamental, in the analyses of components are probably due to the state of purity of the fractions concerned.

In previous papers [19, 20] we have shown that treatment of wool with different concentrations of sulphuric acid can be used to obtain two membranous components which seem to be different fractions of the fibre. These differ in microscopical appearance (Fig. 1 and 2), but it is doubtful, as with previous work, whether either of these could

be obtained in a sufficiently pure state to justify claims for the isolation of a pure fraction.

It was felt, however, that as the treatments are simple and progressive, valuable data could be obtained by carrying out specific amino-acid and other analyses on fibres treated for increasing periods of time, up to that required to give a microscopically characteristic component. In this way, should the final membranous material have a higher or lower content of a certain amino acid, this value should be approached asymptotically with increasing times of treatment. If complete amino-acid analyses are then carried out on the final material, variations from the normal wool values should be indicative of the tendency of certain amino acids to be concentrated in these histological components, or in the more soluble regions of the fibres.

The two treatments used to isolate the membranous materials were as follows—

(*a*) Solution of the bulk of the wool in 47% sulphuric acid at 29°C. As previously shown [19], this leaves a scale-marked resistant membrane after 5 days. This is referred to throughout as *membrane A*.

(*b*) Solution of the bulk of the wool in 98% sulphuric acid at 29°C. followed by extraction with 10% sodium carbonate solution at room temperature for 30 min. After 4 days' acid treatment, the subsequent alkali wash leaves a smooth tubular membrane, referred to as *membrane B*.

Elliott and Roberts [21] had previously isolated a scale-marked membrane (Fig. 3) by boiling wool with 0·05N. potassium hydroxide solution for 105 min. As the membrane is similar in appearance to membrane A, and the method of isolation is chemically simple, the same type of assessment has been carried out upon it. It will be referred to throughout as *membrane C*.

In each case the following constituents were estimated after various treatment times— sulphur, cystine, serine, threonine, and nitrogen. Total amino-acid analyses have been carried out on each final preparation, but it must be pointed out that these are not claimed to be true analytical figures for the individual membranes, but merely serve to indicate the preferential retention of certain constitutional amino acids.

Experimental

The wool used in the work was industrially scoured and carded wool. The wool was hand-picked to remove visible burr material, and chopped to facilitate penetration of the reagent used.

The amount of oil extractable from the wool by continuous extraction with ether (24 hr.) and alcohol (24 hr.) was only 0·5%. This small amount of oil was not, therefore, extracted from the bulk sample.

A. ISOLATION OF PREPARATIONS

(i) *Fractions obtained by Treatment with 47% Sulphuric Acid*

A sample of dried wool was treated with 47% sulphuric acid (liquor ratio 50 : 1) in a separating funnel at 29°C. After leaving for the required time, the wool had risen to the surface of the acid. The excess acid was run off, and the remaining suspension was diluted with its own volume of water. It was then centrifuged, the supernatant liquid removed, and the residual material washed and centrifuged successively until the wash water had pH 5–6. The solid matter was then separated and dried overnight in an air oven at 95°C. By this method, fractions were obtained for analysis after 1, 2, 3, 4, and 5 days' treatment.

(ii) *Fractions isolated by Treatment with 98% Sulphuric Acid and Sodium Carbonate Solution*

A sample of dried wool was treated with concentrated sulphuric acid at 29°C. for the required time, and filtered off through a No. 1 sintered glass crucible. The wool was then washed with ether, acetone, and water, and stirred with distilled water. 1% Sodium carbonate solution was added to neutrality, and the wool filtered off, treated with 10% sodium carbonate solution at room temperature for 30 min., centrifuged, and washed successively until the pH of the wash water was 7–8. The residue was heated in an air oven overnight at 95°C. and used for analysis. By this method, fractions were obtained after 1, 2, 3, and 4 days in concentrated acid, and each fraction was treated in 10% sodium carbonate solution for 30 min.

(iii) *Fractions isolated by Treatment with 0·05N. Potassium Hydroxide*

A sample of dried wool was treated with 0·05N. potassium hydroxide at a liquor ratio of 50 : 1 and boiled for the required time. The wool was then filtered off on a No. 1 sintered glass crucible, and washed until the wash water had pH 7–8. Where times of treatment exceeded 1 hr., the wool was separated by successive centrifuging and washing. The solid material obtained was dried overnight in an air oven at 95°C., and the residue was used for chemical analysis. By this method fractions were obtained for analysis after 15, 30, 45, 60, 75, and 105 min. treatment.

B. WEIGHT-CHANGE DETERMINATIONS

Accurate weight-change determinations were impossible to perform owing to losses of material during washing, centrifuging, etc. An approximate figure for the weight change was obtained by weighing the dried sample of wool before and after treatment.

C. ASH-CONTENT DETERMINATIONS

The ash contents of residual wool samples after treatment were determined by igniting a known weight of dried residual wool to constant weight in a porcelain crucible. The results are expressed as a percentage of the dry weight before ignition.

D. CHEMICAL ANALYSES

Total sulphur analyses were performed using the Benedict–Denis method [22]. Free sulphate was determined by hydrolysis and precipitation with barium chloride solution. Cystine analyses were performed colorimetrically using phosphotungstic acid by the method of Shinohara [23]. Total nitrogen

FIG. 1—Appearance of Fibre after 5 days' Treatment with 47% Sulphuric Acid at 30°C. (× 300)

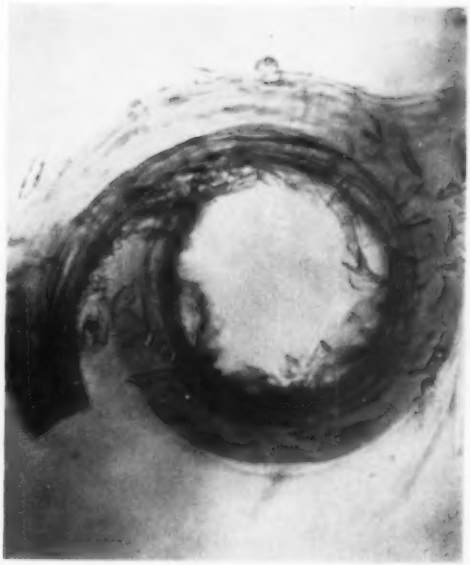

FIG. 2—Appearance of Fibre after 4 days' Treatment with Concentrated Sulphuric Acid and 30 min. with 10% Sodium Carbonate Solution. Note thin ring of stained paracortex (Methylene Blue stain) (× 300)

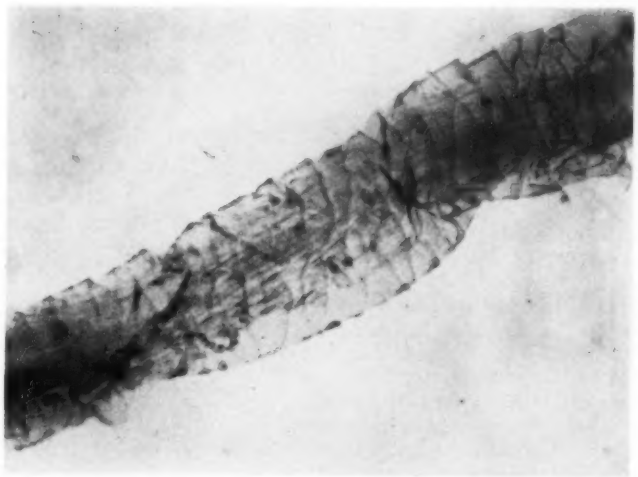

FIG. 3—Appearance of Fibre after 105 min. Treatment with 0·05*N*. Potassium Hydroxide Solution at 100°C. Note small amount of stained cortex inside scalar structure (× 300)

estimations were carried out by the semi-micro Kjeldahl method. Serine and threonine analyses were performed by the periodate oxidation method of Rees[24]. The results of these amino-acid analyses are expressed as percentages of the total wool.

E. TOTAL AMINO-ACID ANALYSIS

Wool samples were hydrolysed with 5·7 N. hydrochloric acid in a sealed tube for 16 hr. Any residual material was filtered off, and the filtrate was evaporated to dryness under reduced pressure. Traces of hydrochloric acid were removed by repeated evaporation with water.

The residue was taken up in citrate buffer of pH 3·31 and made up to 10 ml. with this buffer. Aliquots (1 ml.) were run on a Zeokarb 225 (Permutit) ion-exchange resin using the method of Moore and Stein[25, 26], and the constituent amino acids estimated. Neutral and acidic amino acids were separated on this resin.

Aliquots (1 ml.) were also run on a 15-cm. Dowex column, on which the basic amino acids could be separated. The amino acids were estimated colorimetrically using ninhydrin colour reagent.

Residual ammonia present in the solution was determined by steam distillation with 40% caustic soda solution in the apparatus of Parnas and Wagner. Total nitrogen analyses were performed on identical samples of treated wools by the semi-micro Kjeldahl method. The final analyses are expressed as the nitrogen content of each amino acid as a percentage of the total nitrogen content of the wool.

Discussion and Results

It is convenient to discuss, initially, some chemical analytical results for each individual preparation, and then to compare the total amino-acid analyses of the three preparations.

1. FRACTIONS ISOLATED BY TREATMENT WITH 47% SULPHURIC ACID

Total sulphur, sulphate, nitrogen, serine and threonine, and cystine analyses were carried out on samples of wool treated for 1, 2, 3, 4, and 5 days in 47% sulphuric acid, as it was believed from previous work[19, 20] that these would show variations. The yield of the 5-day sample was very small, and was used only for a total amino-acid analysis and for cystine and nitrogen analyses.

The appearance of the specimen after 5 days' treatment is shown in Fig. 1.

The analytical results for the 1–5 day treatments are shown in Table I.

The rate of dissolution of the fibre is rapid, and each successive day's treatment results in a loss of about 50% of the starting material, so that after 5 days' treatment only 2% of the original weight of the fibre remains. It appears, therefore, that a first-order reaction is taking place, which would be consistent with hydrolytic attack.

The sulphur content of the fibre increases rapidly at first, and then tends to reach a constant value. This increase is mainly due to an increase in cystine content. The high cystine content is possibly the cause of the marked increase in resistance of the membrane to further attack by 47% sulphuric acid.

It is well known[27, 28] that in virgin wool, on analysis, there is a discrepancy between total sulphur in wool and sulphur accountable as cystine, etc. (usually about 0·6% sulphur is unaccounted for). It can be seen from Table I that the treated wools do not show this discrepancy, and, therefore, whatever substances contribute to this discrepancy in whole wool must be preferentially dissolved out in the acid treatment.

Despite the previous history of the wool, fine particles of acid-insoluble impurity remain, and these, which are present to a microscopic extent in the original wool, are concentrated about 25 times in the 4-day sample. Under microscopic examination they appear to be small, broken burr material. This presumably accounts for the low value of 11·1% nitrogen in this sample. Contrary to expectation, this material was apparently resistant to the acid treatment. As a confirmatory test, *ad hoc* particles of impurity were picked from untreated wool, ground in a mortar, and allowed to stand in 47% sulphuric acid at 29°c. with occasional agitation. After 4 days, very little dissolution had occurred, and presumably temperature must have a great effect on rate of dissolution.

In the earlier samples, up to 4 days' treatment, where analytical figures are purely comparative, this impurity is of no great importance, and it can be clearly seen in Table I that the cystine content of the insoluble wool is rising to a high figure. The 5-day sample, however, which the authors believe, from the microscopic evidence and chemical analyses, to be as pure a membrane as it is possible to obtain, had to be prepared free from any such impurities before a valid and full analysis could be carried out. Fortunately, it was relatively easy to purify this final sample by slow centrifuging. The heavier impurities are thrown down preferentially and can be separated from the membrane, which remains in suspension under these conditions. The

TABLE I

Time (days)	Wt. Loss (%)	Cystine (%)	SO_4 (%)	Sulphur (%) as Cystine	Sulphur (%) as SO_4	Sulphur (%) as Cystine $+SO_4$	Total	N (%)	Serine (%)	Threonine (%)	Ash (%)
0	0	11·2	—	2·98	—	2·98	3·48	16·1	9·57	5·85	0·46
1	52	15·1	4·58	4·03	1·53	5·56	5·73	14·2	9·57	6·05	1·60
2	84	21·8	4·20	5·82	1·40	7·22	6·75	—	—	—	0·41
3	92	22·1	4·07	5·88	1·36	7·24	7·30	—	9·22	—	—
4	96	21·8	4·97	5·82	1·66	7·48	7·55	11·1	—	6·03	0·63
5	98	22·8	—	—	—	—	—	12·2	—	—	0·20

TABLE II

Time (days)	Wt. Loss (%)	Cystine (%)	SO_4 (%)	Sulphur (%) as Cystine	Sulphur (%) as SO_4	Sulphur (%) as Cystine + SO_4	Total	N (%)	Serine (%)	Threonine (%)	Ash (%)
0	—	11·2	—	2·98	—	2·98	3·48	16·1	9·57	5·85	0·46
1	54	11·7	8·76	3·12	2·92	6·04	8·72	—	10·50	5·52	5·85
2	66	10·7	6·15	2·86	2·05	4·91	9·85	13·2	10·40	5·55	4·55
3	77	—	—	—	—	—	8·00	—	—	5·62	—
4	78	11·6	4·50	3·10	1·50	4·60	8·72	14·1	10·70	5·47	6·46

5-day sample is, therefore, completely free from any such microscopic impurities.

2. FRACTIONS ISOLATED BY CONCENTRATED ACID TREATMENT FOLLOWED BY ALKALI EXTRACTION

The analytical results for this preparation are shown in Table II. Owing to difficulties of separation of the solid material during the treatment, standard conditions were difficult to achieve, and the results are not as consistent as in the cases of the other two treatments. The appearance of the fibre, after 4 days' treatment with concentrated sulphuric acid followed by 30 min. in 10% sodium carbonate solution, is shown in Fig. 2.

The reaction shows that a rapid initial attack occurs, followed by slower dissolution. The large percentage of sulphur in the residues is due to sulphonation of the tyrosine and phenylalanine residues, as has been shown previously [20, 29, 30], and to the introduction of sulphate ions into the fibre. Cystine contents of the treated samples are approximately constant.

The large discrepancies between the total sulphur contents and the combined sulphur of cystine and sulphate are mainly due to sulphonation of those amino acids which contain a benzene ring. Serine values are slightly higher and threonine slightly lower than those of untreated wool, but the variations are within the limits of experimental error. Qualitative analysis of the large ash contents shows that there are considerable amounts of sodium and sulphate ions therein.

From the analytical figures, particularly those for cystine, it is seen that membrane B differs from that obtained by 47% acid treatment. Thus, despite its resistance to the extremely severe conditions, it has not a markedly high cystine content. The cold alkali treatment has converted only a little of the cystine to lanthionine (see below), and hence the explanation of the resistance of this membrane is not increased cross-linking, as perhaps applies with the first membrane.

3. FRACTIONS ISOLATED BY DILUTE ALKALI TREATMENT

Analyses of wool boiled for increasing periods of time in 0·05N. potassium hydroxide have been carried out, and the results are shown in Table III. The appearance of the preparation after 105 min. treatment is shown in Fig. 3.

The attack of alkali on the wool fibre is again characterised by a rapid initial attack followed by slower dissolution. There is an immediate and rapid fall in cystine and sulphur contents which does not correspond with weight losses or with the isolation of a membrane. The cystine content falls within 15 min. to a value of about 2·5%, which, from then on, remains reasonably constant. This has been observed by other workers [31], and it appears that there is a small fraction of cystine which resists conversion to lanthionine. This agrees with the previous work of Phillips [27]. No full explanation of this resistance to alkaline degradation by a small fraction of the cystine has been given. Cystine estimations were, therefore, not a reliable guide to the point of isolation of a membrane. The existence of the latter could only be deduced by microscopic inspection.

The nitrogen content of the wool remains constant, and a slight decrease in serine is observed. After 105 min. some cortex remained in the fibres, and analytical figures are closer to those of untreated wool than are those for the previous fraction.

4. COMPARISON OF TOTAL AMINO-ACID ANALYSES OF THE THREE MEMBRANES

Total amino-acid analyses have been carried out on the three preparations by the method given above, and the results compared with those for untreated wool. The analyses were performed in duplicate, and the nitrogen content of each acid is expressed as a percentage of the total nitrogen. The averages of the duplicate results are shown in Table IV.

In all three preparations proline and methionine tend to be high, and tyrosine and phenylalanine

TABLE III

Time (min.)	Wt. Loss (%)	Cystine (%)	S (%)	N (%)	Serine (%)	Threonine (%)	Ash (%)
0	0	11·2	3·48	16·10	9·57	5·85	0·46
15	32	2·57	2·50	—	—	—	0·53
30	64	2·75	2·44	15·95	10·10	6·61	—
45	65	2·58	2·43	—	—	—	0·65
60	69	2·64	2·36	—	—	—	—
75	74	2·65	2·26	16·40	9·02	6·07	—
105	—	—	—	16·10	—	—	0·92

TABLE IV

Amino Acid	Wool		Membranes		
	Oxidised [22]	Scoured	A	B	C
Aspartic acid	4·56	4·41	1·74	2·98	3·35
Threonine	4·66	4·76	3·78	4·10	4·07
Serine	7·50	7·61	6·19	10·00	6·95
Glutamic acid	8·50	7·98	6·89	5·87	6·69
Proline	4·89	5·31	7·89	7·74	5·77
Glycine	6·09	5·68	2·28	6·72	5·15
Alanine	3·99	3·74	3·28	3·24	3·56
Cystine	—	6·85 (8·12)*	13·83 (21·90)*	4·14 (9·60)*	1·11 (1·92)*
Lanthionine	—	—	—	1·30	7·35
Valine	3·97	3·66	4·13	3·41	3·88
Methionine	—	0·41	0·73	1·18	0·47
Isoleucine	2·34	1·94	1·61	1·66	1·97
Leucine	5·78	5·64	3·71	3·97	4·41
Tyrosine	2·37	2·67	1·20	0·00	1·58
Phenylalanine	1·90	1·93	0·86	0·45	1·40
Histidine	1·68	1·71	1·27	1·01	1·27
Lysine	4·02	3·87	2·90	2·64	3·96
Arginine	19·20	19·68	15·20	15·60	15·91
Ammonia	9·34	9·68	12·30	11·50	9·67
Humin nitrogen †	—	0·00	0·80	0·00	0·00
Totals	—	97·53 (98·80)	90·59 (98·66)	87·51 (92·97)	88·52 (89·33)

* Shinohara [23]
† Semi-micro Kjeldahl

tend to be low. Membranes B and C have both been isolated by a process involving treatment with alkali, and in each case part of the cystine has been converted into lanthionine. The cystine contents are therefore lower than those of untreated wool. Membrane A has a high cystine content, but the value obtained is considerably lower than that obtained by the Shinohara method. This difference is observed for the other two membranes, and it is difficult to decide which method is the more accurate. The Shinohara values are included in Table IV.

Only in the case of membrane B were any sulphonated amino acids observed. Three unknown amino acids were eluted from the column at the rates expected for such strongly acidic compounds. No attempts have been made to characterise these acids, but they presumably correspond to the phenylalanine-*p*-sulphonic acid and the two tyrosinesulphonic acids previously reported [20].

As the alkali-resistant fraction contained residual cortex, the nitrogen and amino-acid contents will be correspondingly closer to those of the untreated fibre. The analytical figures for total amino acids show that, in all cases except one, lysine, arginine, aspartic acid, glutamic acid, and tyrosine contents are lower than in the intact fibre. The lysine content of membrane C is slightly higher than that of untreated wool. Speakman, Ghosh, and Holker [33] suggest that these acids are found in greater concentration in the amorphous, more accessible regions of the fibre than in the crystalline regions, and it is therefore to be expected that these acids will be located in the more easily attacked parts of the fibre.

Corfield, Robson, and Skinner [32] found that γ-keratose has high cysteic acid, proline, serine, and threonine contents, and low aspartic acid, alanine, glutamic acid, leucine, lysine, tyrosine, and phenylalanine contents. These changes, with the exception of those for the hydroxyamino acids, are, in almost every case, in the same direction as those produced by the present treatments. It is, however, difficult to conceive that the present preparations, which are residual components of the fibre after fairly rigorous treatment, bear any relation to the γ-keratose which is precipitated from wool that has been solubilised by oxidation of the disulphide links.

X-Ray examination by Woods [34] shows that membranes B and C give the expected characteristic patterns of degraded protein. Membrane A is peculiar in that it shows a poorly organised β-pattern. The small degree of order present is in the side-chain direction. In no case are the membranes highly crystalline as measured by X-rays. It would appear, therefore, that membrane A is resistant to acid hydrolysis as a result of the high proportion of cystine.

Though no attempt has been made to identify these membranes with specific, named, histological components, their positions within the fibre are fairly well defined.

Membrane A must surround the cortex of the fibre, as it has been shown [19] that the interior part of the fibre is dissolved, leaving a tubular membrane enclosing the residual cortex. Further, if wool fibres are carefully descaled by rubbing with very fine emery paper, the fibres swell and dissolve much more rapidly in the acid. No trace of a membrane is observed during dissolution, merely a few cortical cells detaching from the fibre edges.

Membrane B must lie below the scales, as the authors have shown [20] that the first effect of 98% sulphuric acid is to break off the scales. The membrane is isolated from the wool after this

process has occurred [19]. It must, however, surround the cortex, as a certain amount of residual cortex is always visible within the membrane.

The method of isolation of membrane C [21] shows that it, too, must surround the cortex, and indeed it closely resembles membrane A in appearance. If these two are the same, however, membrane B is considerably more degraded than membrane A, owing to the attack of the potassium hydroxide on the cystine link. Further, on scraping fibres prior to treatment, this membrane is not observed.

Of the three membranes studied, therefore, only one, membrane A, stands out as an entity which can be clearly defined analytically. It is hoped, in further work, to concentrate on this membrane, and that these analyses will form a starting point for the fuller elucidation of its structure.

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CORRESPONDENCE

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Cotton Duck for Weathering Tests

The purpose of this letter is to acquaint your readers with a unique cotton duck designed particularly for the easy preparation of 1 in. ravelled strips such as those used in soil-burial and weathering tests. This fabric (6·8 oz./sq.yd.) is woven with coloured threads placed at intervals of $\frac{5}{8}$ in. and 1 in.; by cutting between the narrow spacings and ravelling to the coloured threads, 1-in. break specimens are prepared quickly and easily.

A precursor of this fabric has been described in some detail by Shapiro [1], and the presently available fabric is discussed in a later issue of the same journal [2]. It is now in use in various laboratories in six countries. The breaking strength is approx. 105 lb. with a standard deviation of 5·0. The fabric has been kier-boiled to remove all waxes and pectins; hence it can be treated thoroughly and easily with aqueous solutions as well as solvents.

Also available for reference purposes is a quantity of this same fabric containing 1% 2,2′-methylene-bis-(4-chlorophenol). Either of these fabrics may be obtained by writing to one of the undersigned, who will forward the requests to the distributor. The price for the untreated fabric is 80 cents per yard, shipping extra, and that with the fungicide treatment is 5 cents more. The minimum order acceptable for overseas shipment is 25 yd.

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U.S.A.

[1] Shapiro, S., *Text. Research J.*, **26**, 620 (1956).
[2] Idem, *ibid.*, **27**, 753 (1957).

van der Waals and Dispersion Forces

The footnote to correspondence on Cellulose Substantivity [1] seems to have called forth some enquiries about the difference between van der Waals and dispersion forces, and it has been suggested that a further note on the subject would prove useful.

Historically, the term "van der Waals forces" refers to those forces which give rise to deviations from the ideal gas laws—

$$pv = RT$$

and lead to the van der Waals equation—

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$$\left(p + \frac{a}{v^2}\right)(v - b) = RT$$

where a represents the van der Waals forces of attraction between the gas molecules.

More recently these intermolecular forces have been subdivided into three groups— (*a*) dipole forces between substances with permanent dipoles, (*b*) induction forces between a permanent dipole and a polarisable substance, and (*c*) dispersion forces between two non-polar substances. van der Waals died before this happened, but he had obviously left a phrase to trouble posterity, for some writers use the term "van der Waals forces" to cover all three types, whilst others use the term to signify only class (*c*). The term "non-polar van der Waals forces" avoids any ambiguity but is lengthy, and is always liable to be abbreviated into "van der Waals forces".

The difference between polar and non-polar forces lies in the nature of the compound. When a strongly electronegative element, such as oxygen, nitrogen, or halogen, is joined to carbon or hydrogen, a permanent dipole exists, since the electron pair forming the bond is not equally shared by the two atoms and there is a permanent charge separation in the molecule. Hydrogen bonding is a well known example of dipole interaction. In the case of water, the negatively charged oxygen of one molecule attracts the more positively charged hydrogen of an adjacent molecule. Because of the small size of the hydrogen, the two can approach closely and the force is relatively large. The maximum effect is obtained only when the molecules are correctly aligned; at higher temperatures thermal vibration prevents optimum alignment, and the forces are diminished.

Purely hydrocarbon compounds have no marked dipole moment, since carbon and hydrogen are of similar electronegativity. Under the influence of an electric field, e.g. when the substance is placed between electrically charged plates, or is near to a polar molecule, the non-polar molecule can be polarised; i.e. a temporary electron drift can take place within the molecule.

It was F. London who offered the theoretical explanation of class (*c*) forces. He showed that even between two atoms of an inert gas, such as argon, certain attractive forces could be theoretically predicted on the basis of the oscillation of the electrons in the two atoms in a phase relationship, causing "an instantaneous transient self-polarisation". The formula he developed contains a frequency term, and the same theory explains the dispersion of light by such substances; therefore London suggested the term "dispersion forces", but other writers have used the term "London forces" in honour of his work. Dispersion forces are operative between all atoms, they are not temperature-dependent, and they are generally small with the smaller atoms, but larger with the larger atoms, because of the greater polarisability of their greater electron clouds.

In most cases intermolecular forces of all three kinds exist simultaneously, but in the case of the inert gases only type (*c*) are operative, and here the influence of the size of the atom is most apparent— helium 1·2, argon 52, and xenon 217.

W. L. Lead

Textile Department
Nottingham and District Technical College

17th June 1959

[1] Lead, J.S.D.C., **75**, 195 (April 1959).

Notes

Meetings of Council and Committees

August

Council— No meeting

Publications— 18th

International Federation 1959 Congress Co-ordinating Committee— 28th

Colour Index Editorial Board— 14th.

Death

We regret to report the death of Mr. L. G. Lawrie.

Perkin Centenary Fellowship and Scholarship

The Perkin Centenary Fellowship has been awarded to Mr. Brian Whitear, A.R.I.C., of Plaistow, London E.13, a photographic research chemist, and will be tenable from 1st October 1959 in the Department of Chemistry at the University of Southampton, where Mr. Whitear will study a problem related to the photochemical reactions of coloured substances.

Perkin Centenary Scholarships have been awarded to Mr. Ronald R. Cox of Birmingham, tenable at the University of Birmingham; to Mr. B. T. Lawton of Walkden, near Manchester, tenable at the Royal Technical College, Salford; and to Mr. D. J. Pearson of Horsforth, near Leeds, tenable at the Bradford Institute of Technology. Mr. Cox has been a laboratory assistant with a firm of paint and varnish manufacturers, Mr. Lawton a textile chemist with a firm of bleachers and dyers, and Mr. Pearson a trainee chemist with a large dyers' association.

Enquiries relating to the awards should be addressed to the Secretary to the Perkin Centenary Trustees, c/o The Chemical Society, Burlington House, London W.1.

New Books and Publications

Review of Textile Progress
Volume 9, 1957

Manchester and Bradford: The Textile Institute and the Society of Dyers and Colourists. 1958. Pp. 545. Price, 42s. 0d. ($6.00).

The *Review of Textile Progress* for 1957 is divided into eleven sections, which are further divided into subsections. The section headed Physics and Chemistry of Fibrous Materials contains subsections on Fibre Physics (by L. C. Spark), Cellulose Chemistry (Kyle Ward Jr.), Wool, Silk, and Regenerated Protein Fibres— Chemistry (R. L. Wormell) and Synthetic-polymer Fibres— Chemistry (J. Saunders). The subsections of the chapter Fibre Production are Cotton Production (E. Lord), Long Vegetable Fibre Production (R. H. Kirby and C. G. Jarman), Wool and Animal Fibres other than Silk— Production (R. J. Bray), Silk Production (J. Pinte), Fibres manufactured from Cellulose— Production (H. L. Röder) and Synthetic-polymer Fibres— Production (S. B. McFarlane). The subsections in the Fabric Production section are Weaving Preparation and Weaving (M. W. Townsend), Warp Sizing and Sizing Materials (E. H. Jones), Knitting (including Preparation) (J. B. Lancashire), Felt and Non-woven Fabrics (T. Barr) and Carpets (A. H. Levin and G. Robinson). Dyeing (J. Waller and G. W. Lewis) and Textile Printing (A. Howarth) comprise the chapter, Colouring of Textiles. The chapter headed Finishing of Textile Fabrics consists of Finishing Wool Fabrics (R. McD. Burnett) and Finishing of Fabrics other than Wool (R. G. Fargher). Chemical Testing (G. S. Egerton) and Physical Testing (M. W. Alford) make up the chapter, Analysis, Testing, Grading and Defects. In addition there are chapters devoted to Conversion of Fibres into Finished Yarns (A. E. De Barr), Colouring Matters (J. E. Bloor and A. R. Thompson), Laundering and Dry-cleaning (R. M. Robinson), Building and Engineering (G. B. Howcroft) and Electronics and Automation (W. T. Cowhig).

Again[1] one wonders whether too much is attempted within this volume, whether authors feel constrained by the aim of omniscience, and deal too broadly and not deeply enough with their subjects. For example, do the purely scientific sections sufficiently expand material already available in the Society of Dyers and Colourists and Textile Institute abstracts? Is there no demand for review articles like those in the Chemical Society's *Quarterly Reviews* dealing at reasonable length with recent advances in a fairly narrow field? The best plan might be to separate the two functions the *Review* seems to have at present— a literature survey, and a considered, critical review— which always make it fall so awkwardly between two stools.

P. T. Speakman

[1] Speakman, P. T., J.S.D.C., **74**, 586 (1958).

The Theory of Dyeing
An Attempt at its Practical Application

By L. I. Belen'kiĭ. Moscow: Gizlegprom 1958. Pp. 192. Price, 8 roubles 20 kopeks.

To review a Russian textbook is doubly difficult. Few can read the language, even if intensely interested in the subject-matter; yet many may be eager to know how far dyeing theory and practice have progressed in the Soviet Union. Books of this kind can clearly reflect the state of knowledge there, by what the author thinks it necessary to expound. For these reasons it is imperative to give more details of the contents than would be needed for a German or French work.

Significantly, the very first reference in the book is to the Russian translation of Vickerstaff's classic *The Physical Chemistry of Dyeing*. A high proportion is taken from Vickerstaff, but much new and additional material is included, mainly, of course, from Russian sources. The Explanatory Papers on Modern Theory from this *Journal* are extensively quoted, and these and other contributions are satisfactorily abstracted.

The impact of work from this country on the theory of dyeing is shown by the fact that of the 272 references, 110 are English, as against 25 American, 15 German, and 13 French. The *Journal* accounts for 58 of the English contributions— which must arouse our justifiable pride in the pre-eminent position of the Society of Dyers and Colourists. Of the 92 references to Russian work, some seem somewhat forced, but there still remains a considerable body of work which must be taken account of, in any future books in English. Nine of these are "Dissertations", which are possibly not easily available here, although it appears from a study of the *Journal* Index of Abstracts that most have been written up in subsequent publications.

A précis is given of two still unpublished dissertations. One[1] describes experiments on a series of 34 direct dyes applied from a dispersion, and their affinity for cellulose is analysed in terms of the structure of the dyes. The other[2] outlines the conclusions drawn from the application of vat dyes in a dispersed form to cotton by a continuous dyeing process. There is also a mathematical exposition which is an extension of the work of Marshall[3] on the pad–dyeing process, attributed to Pataki *et al.*[4], which does not appear to have been abstracted. The subject is said to have been completed by a T. V. Bromberg, but no reference is given.

An outline of the scope of the book can best be given by listing the main chapters and subheadings—

The Structure of Fibres which are to be Dyed.

The Behaviour of Fibres in Water and Aqueous Solutions of Electrolytes.

The Structure of Dyes: Molecular Models of Dyes.

The Structure of Dyes and their Dyeing Properties.

The Behaviour of Dyes in Water: Solubility, Properties of Solutions of Dyes.

The Interaction of Fibres and Dyes in Aqueous Media: Fibres. Mechanism of the Interaction, Diffusion of Dyes in Textile Sorption (Take-up) of Dyes,

(*a*) general considerations, (*b*) forces between the dye and the fibre, (*c*) the significance of electrical attraction and repulsion, (*d*) the mechanism of the process of dyeing, (*e*) the rôle of the solvent in dyeing, (*f*) the rôle of electrolyte and temperature in direct dyeing, (*g*) comparison of data on the sorption of dyes.

The Behaviour of Dyes on the Fibre.

Theory and Practice of Dyeing Vegetable and Animal Fibres with Different Dyes. Dyeing Cellulosic Fibres with Vat Dyes, Dyeing Artificial and Synthetic Fibres, Dyeing Protein Fibres with Acid Dyes.

A System of Objective Factors for the Assessment of the Dyeing Process.

Control of the Dyeing Process.

Physicochemical Terminology.

The last item is a glossary of definitions of the following terms which A.S.D.C. candidates might find useful if translated, although the topics are very scantily dealt with—active sites, hydrogen bonds, hydrotropy, dipoles, dichroism, Donnan equilibrium, protective colloids, isotherms, isoelectric point, gegenions, insoluble fraction, protons, sorption, affinity, submicroscopic pores, thermodynamics, activation energy, entropy.

The book is very uneven in style and level. Some parts are excellent and worthy of translation; others are so scrappy that they are almost brief notes. On the whole it is on a more popular level than Vickerstaff, and a similar work in English might serve as a useful introduction for students to the theory of dyeing. The half-tone illustrations are poorly reproduced, but the printing and paper are not bad by the usual Soviet standards.

L. PETERS

[1] Shkurina, T. N., *Dissertation* (Inst. Org. Chem., Acad. Sci. U.S.S.R. 1949).
[2] Tanvel, A. Ya., *Dissertation* (Moscow: M.T.I. 1953).
[3] Marshall, W. J., J.S.D.C., **71**, 13 (1955).
[4] Pataki, Bozsó, and Feleki, *Trans. Hung. Text. Inst.* (1953).

Nouvelles Tables de la Colorimétrie
appliquée à la Physiologie de la Couleur

By Frantz Braun. Tome **I**, Pp. 80 + 2 colour plates. Tome **II**, Pp. 124. Tome **III**, Pp. 136. Brussels: Edition–Librairie–Publicité Internationales. 1957. Price, Belgian francs 1,500.

This book consists largely of an extensive set of tables based on the N.B.S. colour-difference formula (as used by the Society in preparing the grey scales). They merely give the co-ordinates on the basic uniform-chromaticity diagram for colours differing from neutral grey by 10 N.B.S. units. These are listed for a large number of wavelengths and 10 different intensities. Their main purpose seems to be that of calculating the co-ordinates of colours which bear definite relations to each other. The author is primarily concerned with colour harmony, and the book is thus of greater interest to designers than to dyers, for whom it has no practical value. The book differs from others on the subject in being based on colour-difference formulae rather than on purely subjective charts such as those of Ostwald and the original Munsell charts.

F. L. WARBURTON

Manufacturers' Publications and Pattern Cards

The Society does not accept any responsibility with regard to the statements in the following notes.
Any publication abstracted may be referred to by members of the Society on application to
Dr. C. B. Stevens, Dyeing Department, Leeds University

Imperial Chemical Industries Ltd.

PROCINYL DYES FOR SYNTHETIC FIBRES—This card describes the first four—Procinyl Yellow G, Orange G, Scarlet G, and Blue R—of a new range of reactive disperse dyes. They are of primary importance on polyamide fibres, to which they are applied from weakly acid aqueous dispersions, under which conditions they are very level dyeing even on irregular-dyeing continuous-filament materials, and covalent reaction between dye and fibre is then brought about by making the dyebath alkaline with sodium carbonate. The rate and extent of combination of dye and fibre increase markedly with rise in temperature, and a minimum of 95°C. is recommended for this stage. Dye which has not combined chemically with the fibre is not removed to any extent by subsequent soaping, but since such dye has moderate wet fastness, the presence of a proportion of it in the final dyeing can be tolerated. Obviously desirable characteristics of these dyes on nylon include very high wet fastness, coupled with level-dyeing characteristics unequalled by any of the anionic dyes and surpassed by only a few disperse dyes, and brilliance of hue. They are also of interest on secondary cellulose acetate rayon and triacetate and on polyacrylonitrile fibres, towards which they behave as normal disperse dyes, there being no evidence of chemical reaction between dye and fibre. One member, Procinyl Yellow G, is particularly recommended for dyeing Terylene in self colours and as a basis for fast browns. They build up well on basified polyacrylonitrile fibres such as Acrilan, giving dyeings of high wet fastness as a result of reaction between dye and fibre, but are of minor interest, as the dyeings have only poor fastness to light. They are also suitable, but of limited interest, for dyeing cellulosic fibres and wool. On silk, wool, and fur skins they are suitable and of interest. Fastness figures on nylon include—

	Light (daylight, Wilmslow)	Washing (Mechanical Wash Test A)	Sublimation (Test A)
Yellow G	6	5	5
Orange G	5	5	4–5
Scarlet G	5–6	5	5
Blue R	5	5	5

TECHNICAL INFORMATION NOTES

Dyehouse No. 472 (Replaces No. 423 and 436)—Dyeing of Terylene/Cellulosic Fibre Unions: Continuous Dyeing using either Cold-dyeing Procion or Procion "H" Dyestuffs—The reactive and disperse dyes are applied simultaneously by padding, the former being fixed by drying followed, if necessary, by steaming and the latter by heating for 15–180 sec. at 170–190°C. For the baking treatment a stenter, hot roll machine or crease-resist baking equipment is suitable. It is emphasised that success depends very largely on control of the process variables and effective mechanical handling of the cloth. In particular sublimation of dye is a major risk since it can not only affect the cloth being processed but by contaminating the cooler parts of the equipment may stain subsequent batches by resubliming during later runs. In certain cases it is recommended that urea be added to the

padding liquor to promote dye uptake but it is also pointed out that baking at high temperatures in presence of urea significantly reduces the fastness of some Procion dyeings to hypochlorite.

Dyehouse No. 473. The Light Fastness of Dyestuffs: I.S.O. and A.A.T.C.C. Ratings— The chief difference between the I.S.O. and A.A.T.C.C. methods of light fastness testing is that each of the blue wool standards used in the former is dyed with a different dye while in the latter the standards are produced by mixing a fast and fugitive component. No official conversion system can thus be devised but a chart is reproduced in this note which is recommended as a generally reliable guide. It has been compiled from data published by Norton, Metzinger, Dillinger and Ekeblad (*de Tex*, 1202, (1958)). The most reliable estimate of the A.A.T.C.C. sunlight rating will be obtained from the I.S.O. (Bombay) figure and the A.A.T.C.C. daylight rating from the I.S.O. (Wilmslow) figure, if the latter is different from the former.

Dyehouse No. 474. Velan NW: Use as a Softener and Water Repellent in the Resin Finishing of Cotton and Viscose Rayon Fabrics— Velan NW is recommended as an addition to resin-finishing precondensates to give a softer handle and overcome the adverse effect of the resin on the tear strength of the finished cloth and also to produce a combined water repellent/crease-resistant finish. Notes on its application are given.

Dyehouse No. 475. Lubrol TW-Scouring Assistant and Antistatic Agent for Use in Worsted System Processing— Lubrol TW is miscible with conventional combing oils and is an excellent antistatic agent for use in worsted drawing and spinning particularly when blends of wool with polyamide, polyester or acrylic fibres are being processed. It may be used instead of mixtures of Lissapol NX and Lubrol MOA for adding to Wool/Terylene slivers during drawing to facilitate removal of combing oil during subsequent scouring.

Dyehouse No. 477. Carbolan and Coomassie Dyestuffs. Application to Wool by the Carbolan Salt A Method— Details are given of improvements in the procedure for applying the Carbolan and Coomassie dyes in presence of Carbolan Salt A. Figures for the optimum initial dyeing temperature, migrating power and exhaustion of 41 Coomassie, Carbolan and Solway dyes are tabulated and it is noted that no less than 14 of these are excellent for shading under the prescribed dyeing conditions.

Dyehouse No. 478 (Supersedes No. 464). Emulsion Thickenings in Textile Printing: Application of a Wide Range of Dyestuffs including Procion, Alcian "X", Caledon and Durindone Vat Dyestuffs— This new note includes details of alternative film-forming agents and further observations on the use of emulsion thickenings when printing synthetic fibres. It is noted that Bedafix 285X is preferred to Bedafix 16X in discharge printing and that the alkali-stabilised sodium alginate previously marketed as Manutex SA/UG is now known as Manutex C.

Dyehouse No. 479 (Replaces No. 320). Wax, Soap and Water Fastness of Pigments in Printing Inks— In the wax fastness test, the use of dry pigment powder gives a more obvious bleed than when the pigment is protected in a printing ink medium and this may be misleading. This new note has been prepared with this factor in mind and the data now presented supplement the previous figure and provide additional information more closely related in many instances to works' practice.

Dyehouse No. 480 (Replaces No. 211). Monastral Fast Blues BXS and GS in Paints, Lacquers and Printing Inks— This note is to remind users that these blue pigments should not be used in presence of solvents unless their stability against crystallisation on storage which leads to a decrease in tinctorial strength. A range of solvents are classified as "Crystallising" and "Non-crystallising", respectively.

Dyehouse No. 482 (Replaces No. 317). Dyeing of Terylene Polyester Fibre: Supplement No. 3. Selection of Disperse Dyes— A range of 11 disperse dyes now preferred for dyeing 100% Terylene are given. They can be applied at temperatures up to 130°c. or with Tumescals D or OP at 100°C. to give dyeings of good fastness to sublimation and pleating by either dry or steam heating.

Dyehouse No. 483. Wet Washing of Carpets— The full wet-washing ("slabbing") of woollen and cotton carpets is best carried out using Lissapol N (10–20 parts per 1000 parts water) applied to the carpet which has been previously wetted-out with warm water or a weak solution of alkali. With cotton carpets addition of 10 parts per 1,000 of Fixanol PM will prevent colour bleeding. Lissapol N is not recommended for shampooing carpets; Lissapol C or D is preferred for this purpose.

Dyehouse No. 484. Dyeing of Wool at High Temperatures (Replaces the Technical Circular entitled "The Dyeing of Wool at High Temperatures" published in 1955)— The suitability of full ranges of level dyeing acid, acid milling and chrome dyes (dyed single-bath and afterchrome) has, when dyed for 1 hr. at 105°c. and 115°c., been determined. Reduction of the dye arising from chemical breakdown of the wool is a more serious problem than acid hydrolysis of the dye in the dyebath. It is clear that dyeings of normal wet-fastness can be obtained in short dyeing times at elevated temperatures. Migration of acid milling dyes dyed under weakly acid conditions is twice as rapid at 105°c., three times more rapid at 110°c. and ten times more rapid at 120°c. compared with 95°c. and the same is true of chrome dyes prior to chroming. There is no evidence of unlevelness arising during chroming owing to migration of chrome. Some figures are included for loss in tensile strength when dyeing for 5–20 min. at 120°c. are given. The maximum temperature recommended for bulk working is 110°c. with a time limit of 1 hr. With after-chrome dyeing complete chroming is achieved in 5–10 min. at 105–110°c.

Dyehouse No. 485. Optical Properties of Pigments in the Near Infra-Red (700–900 mμ)— Recent developments in the use of paint films for thermal insulation and camouflage and the wider use of radiant heat for curing baking enamels have made it necessary for data to be obtained on the optical properties of pigments in the infrared region. Reflectance data are provided for a wide range of organic and inorganic pigments obtained from spectro-photometric measurements on dried paint films applied over black and white grounds. A further table classifies the pigments into optical groups according to their behaviour within the region 700–900 mμ.

Dyehouse No. 487. Cinasol AC for the Softening of Paper— Cinasol AC is a cationic softening agent, 1–3% of which when added (calc. on dry pulp weight) to the stock in the beater gives excellent softening with little or no foaming.

Dyehouse No. 489. Effect of Crease-Resist Resins on Vat Dyes applied to Cotton— The effect on hue and light fastness of the application of urea–formaldehyde, melamine–formaldehyde and cyclic ethylene urea–formaldehyde resins to cotton dyed with the full range of Caledon vat dyes is tabulated. In general there is significant reduction in light fastness and changes in hue are not marked except with a few reds, violets, blues and greys.

Dyestuffs for Nylon Textiles: Acid and Direct Dyestuffs. Vol. 3— This contains data sheets describing a further range of 5 acid dyes and 9 Nylomine dyes, the latter being particularly recommended for their ability to give bright, full depth dyeings of very good fastness to light and wet treatments particularly if "back-tanned".

Dyestuffs and Pigments for Paper— This card contains colourings in two depths of 78 water-soluble acid, basic and direct dyes and 14 pigments including inorganic pigments, azoics, vats, phthalocyanines and carbon black. The text includes details of the method of application and uses of each type and descriptions of methods of assessment of fastness characteristics and of a method and apparatus for colour matching in the laboratory.

Duranol Direct Black T— This disperse dye gives full blacks of very good fastness to light, heat treatments and washing on Terylene when applied at 120–130°c. or in presence of a carrier. For good fastness to rubbing it is essential to add Dispersol AC to the dyebath. Lissapols C or D should only be used in addition to Dispersol AC when Tumescals D, OP and PH are present. It is not recommended for greys and azoics are still preferred where the highest fastness to heat treatments is essential. It is of some interest on secondary cellulose acetate rayon and on triacetate but not on polyamide or polyacrylonitrile fibres. Fastness for a 10% dyeing on Terylene include— Light 6–7 (dyed at 120–130°c.), sublimation-staining of adjacent Terylene 2, washing (Test No. 2, once at 55°c.) 4–5.

Monolite Yellow GLS— A benzidine yellow type of pigment, brighter than the Yellow GTS brand, of particular interest in printing inks and for industrial finishes and also of some interest in decorative paints and for colouring linoleum and flooring compositions.

Monastral Fast Blue LBXS— A pure phthalocyanine greenish-blue pigment intended primarily for use in compositions containing solvents— particularly aromatic hydrocarbons— which cause normal phthalocyanine pigments to crystallise, resulting in loss in tinctorial strength, change in hue and in some cases thickening of the ink.

Naphthalene Leather Grey N— A homogeneous premetallised dye giving neutral greys of high fastness to light. It is particularly suitable for dyeing full-chrome tanned leathers and also gives very level dyeings on mordant chrome gloving and semichrome clothing leather. It is not suitable for brush or spray staining of upholstery hides. Characteristics include— Penetration 1, solubility 4, fastness to light 5.

Pure Scarlet Chrome LMS— A molybdated lead chrome pigment of particular interest for full-depth industrial finishes required to have excellent hiding power. It is also of interest for printing inks and for colouring plastics.

Supra Middle Chrome GS— A lead chrome pigment containing less than 5% of soluble lead when tested according to *B.S.* 282:1953. It is of particular interest for medium- to full-depth industrial stoving finishes required to have excellent weathering fastness.

Abstracts from British and Foreign Journals and Patents

The titles of abstracts may be modified. Abbreviations of names of firms are listed in J.S.D.C., **68**, *23 (Jan. 1952) and also, together with symbols and the periodicals abstracted, in the annual index*

I— PLANT; MACHINERY; BUILDINGS

Carbon Black, C.I. Pigment Black 6 and 7, from Coke-oven Gas

Chem. Ing. Tech., **31**, 18–20 (1959): *Chem. Abs.*, **53**, 7562 (25 April 1959)

Carbon Black is produced during the thermal cracking of CH_4-containing coke oven gas to synthesis gas. Large scale experiments with various filtering arrangements are described and some operating costs given. C.O.C.

Heat Economy in Textile Plants

F. G. Green *TIDU* 6419*

Pp. 16. Microfilm 4s. 0d. Enl. pr. 20s. 0d.

A short review issued by Technical Information Services, Canada, of some methods of economising steam and fuel consumption. An annotated bibliography covers the period 1944–57. C.O.C.

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PATENTS

Quenching the Smoke from Carbon Black Furnaces

Phillips Petroleum Co. *USP* 2,873,172

Applying Emulsions to Jute during its Preliminary Processing

Douglas Fraser & Sons *BP* 815,120

Apparatus for Applying Sighting Colours

Fiber Controls Corpn. *USP* 2,873,483

Apparatus which applies sighting colour evenly throughout a blend of fibres after opening and before further processing. C.O.C.

Uncurling and Setting the Selvedges of a Fabric

Canadian Celanese *BP* 814,846

Apparatus suitable for uncurling the selvedges of warp knit fabrics and setting them in a flat condition. C.O.C.

Treating Textiles with Liquids or Gases

Gebruder Sucker *BP* 814,127

Impulses of basic frequency 1–16 cycles per sec. are imparted to the liquid or gas in which the textiles are contained. This effects rapid and very uniform saturation of the textiles with the liquid or gas. C.O.C.

Production of Matched Embossing Rollers

Modern Engraving & Machine Co. *BP* 814,565

Electrostatic Flock Printing Machines

Velveray Corpn. *BP* 814,728

Printing of Pile Fabrics (IX p. 475)

Stencil Printing of Plastic on to Permeable Material (IX p. 475)

Dry Sizing (X p. 476)

III— CHEMICALS; AUXILIARY PRODUCTS; FINISHING MATERIALS

Cadoxen, a Colourless Aqueous Solvent for Cellulose

G. Jayme *Das Papier*, **12**, 624–632 (1958): *Chem. Abs.*, **53**, 9653 (25 May 1959)

Cadoxen is a solution of $[Cd(en)_3][OH]_2$. It is a clear, colourless stable solution which dissolves cellulose. Its uses in the examination of paper pulp are described. C.O.C.

Carrotting Liquor containing No Mercury

A. Janiszewska

Prace Centr. Inst. Ochrony Pracy, **6**, (2) 23–8 (1956): *Chem. Abs.*, **53**, 5684 (25 March 1959)

25 g. $K_2Cr_2O_7$ in 750 ml. hot water are mixed with 100 g. $KClO_3$ in 100 ml. hot water. To this mixture are added 175 ml. HCl (s.g. 1·15) and 500 ml. 30% H_2O_2. This is painted on to the hair of rabbitskins which are then dried, cropped and the hair left for 2–3 months before further processing. C.O.C.

Mothproofing Agents and Dyes

B. U. Bogoslovskii and F. I. Rakhlina

Izvest. Vysshikh Ucheb. Zavedenii Tekhnol. Tekstil. Prom. (3) 118–121 (1938); *Chem. Abs.*, **53**, 5610 (10 April 1959)

Mothproofing agents which exhaust on to wool from an acid bath and which are fast to light and washing are obtained by condensing 4-chlorobenzenesulphonic acid chloride with either (1) diethanolamine followed by esterification of the OH groups with SO_2ClOH; (2) 4,4′-diaminostilbene-2,2′-disulphonic acid; or (3) its sodium salt. Synthesis of an anthraquinone blue acid dye having mothproofing properties is also described. C.O.C.

Mildew Prevention

H. Iwamoto, K. Kurihara, and M. Shiga

VI— Classification of Moulds given on Various Materials. 1

Makkô Kyôkaishi, **16**, 174–180 (1958)

More than 234 species of moulds have been found on leather, textiles, paints, synthetic resins, etc.

VII— Identity of Moulds given on Various Materials. 2

Ibid., 201–8: *Chem. Abs.*, **53**, 9551 (25 May 1959)

The fungicidal properties of phenolic compounds have been tested against 30 species of moulds. Activity of chlorinated phenol was intimately related to the number of Cl atoms, being stronger the more Cl atoms present. 2,5-Dinitrophenol and phenyl phenol exerted considerable effect while *p*-nitrophenol had little effect. *m*- and *p*-Chlorophenol are more effective than *o*-chlorophenol. Pentachlorophenol was the most effective and its Al, Fe and Na salts are also very effective. *Rhizopus nigricans*, *Aspergillus flavus*, *Sterigmatocystis japonica*, *Fusarium moniliforme* and *A. niger* were very resistant to the

chlorophenols and *A. flavus*, *S. japonica* and *Penicillium luteum* had considerable resistance to nitrophenols. C.O.C.

Complex Compounds as Driers
F. Erbe
Fette, Seifen, Anstrichmittel, **59**, 1069–1071 (1957): *Chem. Abs.*, **53**, 5701 (25 March 1959)

Use of the chelates of such metals as Co, Mn, and Pb with 2,2′-bipyridine, 1,10-phenanthroline, haemin, chlorophyll, porphyrazine, and *o*-hydroxy carbonyl compounds such as salicylaldehyde and *o*-hydroxyacetophenone, as driers, particularly for oils, is discussed. C.O.C.

PATENTS

Polymeric Emulsifying Agents
A. I. Medalia and H. H. Freedman *USP* 2,874,151

Describes production of emulsifying agents containing a $CH_2{:}C<$ group in which at least one of the free valences of the C atom is attached to an electro active group, e.g. K poly-[10-(*p*-styryl)undecanoate]. 49 examples are given. C.O.C.

Quaternary Ammonium Compounds— Textile Assistants
Ciba *BP* 814,721

Water-soluble compounds containing at least two quaternary N atoms each having bound to it one epoxy propyl group and one or two *N*-hydroxyethyl or *N*-hydroxy-(mono- or poly-ethoxy)-ethyl groups, have wide uses as textile assistants, e.g. for coating glass fibres; as softening and antistatic agents. They are produced by reacting epichlorohydrin under anhydrous conditions with the addition products of 2 mol. ethylene oxide and one mol. of piperazine or a diacylated triethylene tetramine (acyl of 12–18 C), or of 4–15 mol. ethylene oxide and 1 mol. of a diamine containing an Alk of 12–18 C directly linked to a *N* atom. The mol. of ethylene oxide used are $\leqslant$ the number of amino H atoms in the polyamines, whose NH_4 compounds have been obtained by reacting epichlorohydrin in absence of water with the addition product of 4 mol. ethylene oxide and 1 mol. *N*,*N*′-di-(β-cyanoethyl)-diethylene triamine, one OH group in the addition product having been esterified with a fatty acid of 12–18 C. The amount of epichlorohydrin must be sufficient to quaternise $\leqslant$ 2 tertiary amino N atoms. C.O.C.

Inhibiting the Corrosive Action of Sequestering Agents
Thomas Hedley & Co. *BP* 814,858

Compounds of formula $R(OC_2H_4)_xOPO_2MN$ (R = Alk of 14–22 C; x = 1–7; M and N = same or different H, Na, K, NH_4 or alkylol subst. ammonia) e.g. phosphated reaction product of 2 mol. ethyleneoxide with 1 mol. hardened sperm alcohol added to ethylene diamine tetra-acetic acid, hydroxy alkyl ethylene diamine triacetic acids and nitrolo triacetic acid inhibit their corrosive action on aluminium and zinc. C.O.C.

Water-soluble Organic Isothiuronium Salts— Emulsifying Agents
FH *BP* 815,226

The products obtained by reacting a 1,1,1-ω-tetrahalogenoalkene or a 1,1-ω-trihalogenoalkene-(1) of formula —

$$Hal_3C{\cdot}(CH_2{\cdot}CH_2)_n{-}Hal \text{ or } Hal_2C{:}CH{\cdot}CH_2{\cdot}(CH_2{\cdot}CH_2)_{n-1}{\cdot}Hal$$

(Hal = Cl or Br; n = 1–10) with thiourea or a subst. thiourea when n = 4–10, are good emulsifiers and softening agents for chlorinated hydrocarbons, especially tetrachloroalkanes of formula $Cl(CH_2)_nCCl_3$, and polyvinyl chloride. C.O.C.

Agents to Prevent Redeposition of Soil on to Cloth during Washing or Dry Cleaning
American Cyanamid Co. *USP* 2,874,124

Presence of polymers of *N*-vinyl-2-oxazolidone prevents soil from being deposited on to cloth during washing or dry cleaning. C.O.C.

Self-emulsifiable Polyester–Aminoplast Condensates
Rohm & Haas Co. *BP* 815,179

Polyesters of average mol.wt. 800–1500 and containing OH groups which can condense with an aminoplast and free carboxyl groups which can combine with ammonia, an amine or a quaternary compound, when condensed with an aminoplast yield products which readily form dispersions by simply stirring them in water. They have wide uses the aqueous dispersions being especially suitable for coating textiles and as binders in pigment printing and dyeing. C.O.C.

Aminoorgano Ethers— Auxiliary Agents and Gas Fading Inhibitors
Rohm & Haas Co. *BP* 815,229

Compounds of formula —

$$CH_2{:}CHOZC(R^1)(R^2)NHR^3$$

or

$$CH_2{:}CHOANHC(R^1)(R^2)(R^4)$$

(Z = divalent saturated hydrocarbon group; R^1 and R^2 = same or different Alk of 1–4 C; R^3 = H, a hydrocarbon of 1–18 C, heterocyclic or heterocyclic substituted hydrocarbon; R^4 = Alk of 1–21 C; A = hydrocarbon of 2–18 C giving a chain of $>$ 1 C atom between the ether O and the N) have a wide variety of uses. Thus they have insecticidal and fungicidal properties, are useful as additives in other aminoplast resins and when reacted with alkylene oxides yield nonionic surface active products for use in the textile, paper, and leather trades. The compound $CH_2{:}CHOCH_2C(CH_3)(C_4H_9)NH_2$ is useful for adding to cellulose acetate spinning dope as a gas fading inhibitor. C.O.C.

Reducing the Flow of Unsaturated Polyester Resin Compositions
British Industrial Plastics *BP* 815,084

A thixotropic composition comprises a crystalline unsaturated polyester resin, an amorphous unsaturated polyester resin and a liquid copolymerisable monomer. The crystalline resin is liquefied to blend it with the amorphous resin and is then recrystallised in the blend. Such a composition can be applied uniformly to fibrous materials without it tending to flow after application. C.O.C.

Aqueous Emulsions or Polyepoxides for treating Textiles, Leather or Paper and as Surface Coatings
Shell Development Co. *USP* 2,872,427

The aqueous emulsions obtained by dispersing a polyepoxide, e.g. epoxidised glycerol trioleate, in water containing a binding colloid, e.g. polyvinyl alcohol, and a non-ionic emulsifying agent stable to acid and alkali, e.g. sorbitan monolaurate, are very stable and can be kept for months without deteriorating. They are readily applied to textiles, leather, paper etc. and cured in presence of epoxy curing agents to impart shrink and crease resistance, increased wet strength, to produce starch-like finishes fast to washing and dry cleaning, etc. They may also be used in producing paints and enamels. C.O.C.

Mono- and Polymeric Aminoalkyl Acyl Titanates
National Lead Co. *BP* 815,159

Describes the preparation of aminotitanium compounds which are readily soluble and resistant to hydrolysis in non-polar organic solvents. Preparation of colloidal aqueous solutions of such compounds is also described, these solutions being used as water-repellent finishes, dispersing agents and for imparting surface activity to various bodies. C.O.C.

Polyepoxide Emulsions for Producing Water-repellent Finishes
Shell Development Co. *USP* 2,872,428

Application of a polyepoxide and a dissimilar compound having a straight chain of $>$ 11 aliphatic C atoms and at least one group reactive with epoxy groups followed by baking yields a very good water-repellent finish. There is little increase in weight and no change in tensile and tear strength, abrasion resistance or handle. There is some increase in crease and shrink resistance. C.O.C.

Aldehyde Condensates for Improving the Wet Fastness of Direct Dyeings and Prints
Ciba *BP* 814,288

A noncyclic compound containing at least one

group is condensed first at $>$ 100°c. with an aldehyde and a salt of an aliphatic amine containing $>$ 1 primary or secondary amino group and then with an aldehyde and a water-soluble NH_4 or amine salt in presence of a solvent. The product is used to improve the wet fastness of dyeings

or prints made with direct dyes whose solubility in water is caused by presence of sulphonic or carboxylic acid groups. Thus ethylene diamine dihydrochloride is heated at 250–255°c. with dicyandiamide. The product is cooled to 220°c., boric acid added followed by further cooling to 152°c. when glacial acetic acid is added. After cooling to 110–113°c. paraformaldehyde (95·7% strength) is added and then at 100°c. aqueous formaldehyde. The whole is then refluxed at 100°c., cooled, neutralised with $NaHCO_3$. This is then boiled under reflux with NH_4Cl and HCHO and finally dried at 50–60°c. under reduced pressure. The colourless product is soluble in hot water and is used for aftertreating dyeings of direct dyes. C.O.C.

Poly(vinyl Methyl Ether) Compositions for Improving Rubbing Fastness
General Aniline *USP* 2,874,136

Poly(vinyl methyl ether), polyvinyl chloride and water-dispersible polyamides when applied to dyed or printed textiles much improve the fastness to rubbing. Poly(vinyl methyl ether) by itself gives marked improvement in wet rubbing fastness but incorporation of a small amount of a lubricant not only improves the fastness to wet rubbing but results in very marked improvement of the fastness to dry rubbing. C.O.C.

Solvent for Polyacrylonitrile
Courtaulds *BP* 814,673

A homogeneous solution of a tetraethyl ammonium salt in an organic compound containing a nitrile group, e.g. tetraethyl ammonium chloride (70 parts) in acetonitrile (30), is a good solvent for polyacrylonitrile. C.O.C.

Fungicides
BASF *BP* 815,538

Compounds of formula—

$$R{\cdot}N(NO){\cdot}OX$$

(R = aliphatic, araliphatic or cyclo aliphatic radical; X = H, one equivalent of a metal or an alkyl-mercury, alkoxyalkyl mercury, aryl-mercury, halogen-mercury or ammonium or subst. ammonium radical), e.g. *N*-nitroso-*N*-cyclohexylhydroxylamine ammonium salt, are more effective fungicides and are more stable than the corresponding aryl-substituted compounds and in addition are less toxic. C.O.C.

Water-repellent Finish for Paper, Textiles, etc. and Mothproof Finish for Wool and Furs
Petren Products *USP* 2,874,075

Pb acetate (48 g.) in water (500 c.c.) is mixed with K alum (32 g.) in water (500 c.c.), stood until all the $PbSO_4$ has settled and the clear liquor decanted off. This solution is then used to waterproof paper, textiles, etc. Textiles treated with it are also given protection against mildew and wool and furs protection against attack by moths and other insects. C.O.C.

Liquid Rosin Sizes which do not Stratify on Storage
American Cyanamid Co. *USP* 2,873,203

Addition of a 0·7–5·0% (on wt. of solids) of NaCl to liquid rosin sizes prevents stratification or other separation when the sizes are kept for long periods. C.O.C.

Reserves for Use in Fur and Leather Dyeing (VIII p. 474)

IV— RAW MATERIALS; INTERMEDIATES; COLOURING MATTERS

Electron-gas Model of Organic Dyes. Absorption Anomalies caused by the Field Effect
H. Kuhn and W. Huber *Helv. chim. Acta*, **42**, 363–386 (Feb. 1959)

Previous attempts to calculate the absorption bands on the basis of the electron gas model for the π-electrons gave good agreement with the observations only if the compound had only one intense band. The present extensive quantum mechanical treatment is an attempt to extend the validity of the results. Better agreement with the observations for pigments of the porphyrin type is obtained by assuming that the 18 π-electrons behave as a system of coupled oscillators which have specific responses to polarised radiation. E.V.T.

Oscillator Strength of Absorption Band in Dye Molecules
H. Kuhn *J. Chem. Phys.*, **29**, 958–9 (1958): *Chem. Abs.*, **53**, 3868 (10 March 1959)

The absorption band corresponds to the jump of an electron from a lower quantum state *A* to a higher state *B*. As there are two electrons in state *A*, both being able to carry out the transition, the total oscillator strength is double the value of a single electron jump. Mathematical proof is given. C.O.C.

Sulphonic Acids of Sulphones as By-products in Sulphonation. V— Some Factors affecting the Formation of Sulphonic Acids of Sulphones
A. P. Shestov and N. A. Osipova *Zhur. obshch. khim.*, **29**, 595–599 (Feb. 1959)

The formation of diphenylsulphone sulphonic acids (I) in the sulphonation of benzene with oleum occurs with the intermediate formation of diphenylsulphone as well as directly from benzenemonosulphonic acid. Benzene-*m*-disulphonic acid, under the conditions of sulphonation, does not transform into I. Na_2SO_4 retards the formation of I during the sulphonation of benzene with oleum. G.J.K.

Reaction of Ethers with Aniline and Ammonia. III— Alkylation of Aniline with Dimethyl Ether
S. V. Dobrovol'skiĭ and V. Ya. Polotnyuk *Zhur. obshch. khim.*, **29**, 545–551 (Feb. 1959)

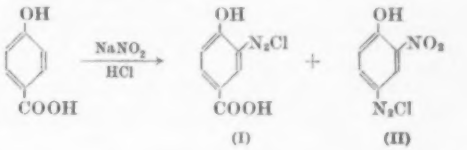
The reaction kinetics in the alkylation of aniline with dimethyl ether have been studied. It is shown that methylation of aniline on activated alumina (211–281°c.) occurs progressively on the N atom

$$C_6H_5NH_2 + (CH_3)_2O \rightleftharpoons C_6H_5NHCH_3 + CH_3OH \quad (I)$$
$$C_6H_5NHCH_3 + (CH_3)_2O \rightleftharpoons C_6H_5N(CH_3)_2 + CH_3OH \quad (II)$$

The activation energies and the ratio of the rate constants of the reactions I and II have been calculated. An empirical equation for the evaluation of the rate constant of the reaction, based on Langmuir's theory of heterogeneous processes, and a detailed diagram of the experimental apparatus are given. G.J.K.

"Diazoation" of *p*-Hydroxybenzoic Acid and Phenol-*p*-sulphonic Acid
V. M. Belikov *Izvestiya Akad. Nauk S.S.S.R., otdel khim. nauk*, (12), 1486–1487 (Dec. 1958)

The Rodionov–Matveev reaction (*Ber.*, **57**, 1711 (1924)) has been applied to *p*-hydroxybenzoic acid and phenol-*p*-sulphonic acid to give diazonium compounds in a 75–90% yield. Treatment of the latter by the Sandmeyer reaction gives *m*-chloro-*p*-hydroxybenzoic acid and *p*-chloro-*o*-nitrophenol indicating the primary products of diazoation to be I and II respectively —



(I) (II)

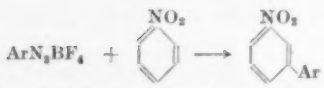
G.J.K.

Synthesis of Organo-metallic Compounds of Quinquevalent Antimony through Arylation of $ArSbX_2$ and Ar_2SbX with Diazo Compounds
A. N. Nesmeyanov, O. A. Reutov, O. A. Ptitsyna, and P. A. Tsurkan *Izvestiya Akad. Nauk S.S.S.R., otdel khim. nauk*, (12), 1435–1444 (Dec. 1958)

The above arylations have been investigated and the preparation of compounds of the type $ArAr'SbX_2$ and $Ar_2Ar'SbX_2$ (e.g. Ar = C_6H_5, Ar' = $CH_2C_6H_4$) described in detail. A table of 20 organo-antimony compds. is given showing yields and identification properties. G.J.K.

Reactions of Aryldiazonium Fluoroborates with Nitrobenzene
L. G. Makarova, M. K. Matveeva, and E. A. Gribchenko *Izvestiya Akad. Nauk S.S.S.R., otdel khim. nauk*, (12), 1452–1460 (Dec. 1958)

Above reactions (aryl = phenyl; *p*-tolyl; *p*-methoxyphenyl; *p*-chlorophenyl; *o*-carboxymethoxyphenyl, or *p*-carboxyethoxyphenyl) have been investigated spectrophotometrically in the ultraviolet region and shown to yield *meta* substitution only—

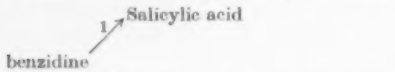


On the other hand, the reaction of *o*-nitro- and *o*-chlorobenzenediazonium fluoroborates with nitrobenzene gives *ortho* substitution. Preparative methods and analytical results are given in detail. G.J.K.

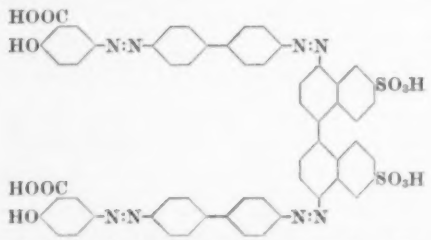
Aromatic Diazo and Azo Compounds. XXXI—Decomposition of Diazo Compounds Derived from Azo Dyes having Cleve's Acid as End Component

K. Stajner, F. Mužík, Z. J. Allan, and J. Poskočil
Chem. listy, **52**, 1304–1309 (1958): *Chem. Abs.*, **53**, 5679 (25 March 1959)

C.I. Direct Brown 162, prepared by the route—



was shown by paper chromatography to contain only 45% of the expected trisazo dye, and 40% of the tetrakisazo compound—



Diazotisation of the monoazo compound aniline-2,5-disulphonic acid→Cleve's acid followed by treatment with aq. Na_2CO_3 was also shown to give 65–85% of similar binaphthyl azo compounds. E.S.

Mechanisms of the Wallach Rearrangement

P. H. Gore *Chem. and Ind.*, (6), 191–192 (7 Feb. 1959)

Study of the Wallach rearrangement (WR) of azoxybenzene (I) to *p*-hydroxyazobenzene (II) using labelled N*

$$Ph{\cdot}NO{:}N^{*}{\cdot}Ph\ (I) \rightarrow Ph{\cdot}N{:}N^{*}O{\cdot}C_6H_4OH\ (II)$$

showed that the two rings were hydroxylated to the same extent, and so an intermediate cyclic oxide was postulated. (I) recovered after the WR is unchanged. At higher temperatures there was an excess of (II), in which the oxygen enters the far ring, so a second mechanism for higher temp. was postulated. Rescrutiny of the data confirms the dual mechanism concept, the second mechanism having a higher (1·5 Kcal./mole) activation energy. Study of the WR with the isomers (III) and (IV)

$Ph{\cdot}NO{:}N{\cdot}C_6H_4NO_2$ (p) (III) $Ph{\cdot}N{:}NO{\cdot}C_6H_4NO_2$ (p) (IV)

shows that (III) rearranges slowly, but (IV) changes rapidly to (III) and slowly to WR products. It is not possible to determine whether (IV) goes to WR products directly or only via (III). E.V.T.

Dyes with Antipyrine Nuclei. VI—Dyes with one Antipyrine Nucleus

O. F. Ginzburg, D. V. Ioffe, and P. M. Zavlin
Zhur. obshch. khim., **29**, 519–522 (Feb. 1959)

Dyes of the triarylmethane series containing one antipyrine ring are obtained from the reactions of (*a*) antipyryl phenyl ketone (I) with dimethylaniline (II), and (*b*) Michler's ketone with antipyrine. The asymmetric dye from I and II has higher hydrolysis stability than Malachite Green and Antipyrine Orange. Absorption spectra (400–650 mμ.) of the new dyes are given. G.J.K.

Azo-Carbazole Dyes

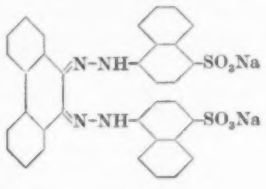
Z. V. Pushkareva and S. T. Omelchenko
Zhur. priklad. khim., **32**, 467–469 (Feb. 1959)

A number of good azo dyes, suitable for dyeing fast shades on cotton, rayon, silk, and caprolactam fibre are produced by coupling 3-diazocarbazole with suitable aminonaphtholsulphonic acids and their phenyl derivatives. A whole range of shades ranging from black to golden yellow were produced. T.Z.W.

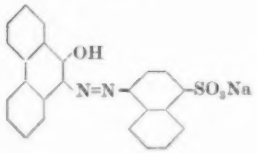
Constitution of Phenanthrene Red

M. Kamel and R. Wizinger
Helv. chim. Acta, **42**, 128–130 (Feb. 1959)

According to Schultz's Dyestuff Tables, phenanthrene red (I) is—



(I)



(II)

It is prepared by the action of 2 mol. of 1-naphthylhydrazine-4-sulphonic acid on finely powdered phenanthraquinone (P). However, action of aryl hydrazines on P always gives a monohydrazone, so that formula (II) is more likely. That (II) is the correct formula follows readily from analysis for N and S. Proof was obtained by reducing (II) with $SnCl_2$/HCl and identifying the product, 9-amino-10-hydroxyphenanthrene and its N-acetyl derivative. (*In German.*) E.V.T.

Absorption Spectra of Dyes. II—Non-additivity of Absorption Spectra of Binary Mixtures of a Direct Dye and some Acid Dyes in Aqueous Solution

Y. Tanizaki, T. Yobayashi, and N. Ando
Bull. Chem. Soc. Japan, **32**, 119–124 (Feb. 1959)

The absorption spectra of mixtures of Direct Sky Blue 6B (C.I. Direct Blue 1) with *p*-X-aniline→γ-acid (where X is H–, CH_3–, CH_3O–, Cl– or NO_2 and coupling is with respect to both hydroxy and amino groups of γ-acid) are non-additive. The non-additivity is explained by interaction between the corresponding bands of the components. A.J.

Photochemical Reactions between Methylene Blue and Tri-, Di-, and Mono-methylamine. III—Behaviour of Methylene Blue in the Presence of Oxygen

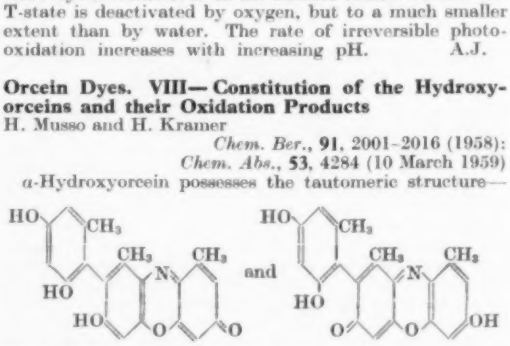
H. Obata, K. Kogasaka, and M. Koizumi
Bull. Chem. Soc. Japan, **32**, 125–132 (Feb. 1959)

In irradiated aq. soln. of Methylene Blue (C.I. Basic Blue 9) containing trimethylamine and oxygen, the triplet (T) state of the dye is not attacked by oxygen but leuco-dye is reoxidised. In the absence of added amine the T-state is deactivated by oxygen, but to a much smaller extent than by water. The rate of irreversible photo-oxidation increases with increasing pH. A.J.

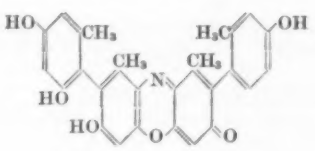
Orcein Dyes. VIII—Constitution of the Hydroxyorceins and their Oxidation Products

H. Musso and H. Kramer
Chem. Ber., **91**, 2001–2016 (1958): *Chem. Abs.*, **53**, 4284 (10 March 1959)

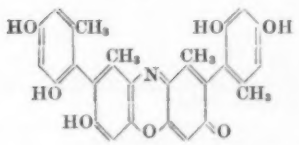
a-Hydroxyorcein possesses the tautomeric structure—



while β and γ-hydroxyorcein are



and



respectively. C.O.C.

Photoconductance of Indigo

A. T. Vartanyan and L. D. Rozenshteĭn
Doklady Akad. Nauk S.S.S.R., **124**, 295–297 (11 Jan. 1959)

Thin layers of indigo (tenths to tens of millimicrons thick) have been deposited in a vacuum (10^{-5} mm.) at 130–140°c. and the photoelectric sensitivity to monochromatic light determined. Spectral curves of the relative photoelectric sensitivity at wave-lengths of 450–800 mμ. are shown for (*a*) the thinnest layer obtained, (*b*) a thick layer, (*c*) thinnest layer in the presence of oxygen, (*d*) solid layer of indigo. These curves show the form of the curve to depend on the thickness of the indigo layer whilst the presence of O_2, increasing the general sensitivity, does not affect the spectral distribution. The energy of activation of indigo under vacuum conditions is determined as 1·75 ± 0·05 e.v. G.J.K.

cis–trans Isomerism of Thioindigo Dyes in the Solid State

G. S. Egerton *Nature*, **183**, 389–390 (7 Feb. 1959)

In solution thioindigo exists as a mixture of *cis* and *trans* forms, but in the crystalline solid it is entirely *trans*. Spectral analysis of films deposited on quartz shows that the *trans* configuration is preferred when substituents do not diminish the charges on the O and S atoms, otherwise a *cis–trans* mixture is found. On cellulose films the dye is a stable mixture of *cis* and *trans* but the proportion of *trans* can sometimes be increased by swelling treatments. E.V.T

Migration of Hydrogen in Redox Reactions. XII— Reduction of Triphenyl Carbinol

É. P. Dar'eva and G. P. Miklukhin
Zhur. obshch. khim., **29**, 625–630 (Feb. 1959)

The mechanism of the reduction of triphenylcarbinol (I) with formic acid, methanol, and ethanol, in the presence of $ZnCl_2$, has been studied using deuterium. It is shown that in all cases hydrogen from the C–H bond of the reducer migrates into the triphenylmethane formed. The kinetic isotope effects in the reduction of I with CH_3DOH and DCOOH are 1·6 and 1·8 respectively. G.J.K.

Synthesis of Copper Phthalocyanine (C.I. 74160) from Phthalic Anhydride

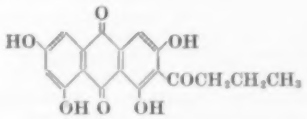
V. F. Borodkin and K. V. Usacheva
Izvest. Vysshykh Ucheb. Zavedeniĭ, Khim. i Khim. Tekhnol. (3), 142–5 (1958): *Chem. Abs.*, **53**, 4295 (10 March 1959)

A study of the influence of metal oxides and salts and of different solvents in the yield of copper phthalocyanine synthesised from phthalic anhydride. Catalyst and % yield were: H_2BO_3, 26·3; $(NH_4)_2Cr_2O_7$, 27·3; Cr_2O_3, 41·0; H_2SeO_4, 48·0; NH_4Cl, 51·2; $FeCl_3$, 60·0; KVO_3, 40·0; HVO_3, 63·0; PbO, 65·0; PbO_2, 66·5; ZnO, 51·2; As_2O_3, 65·0; As_2O_5, 66·5; Sb_2O_3, 75·0; MoO_3, 78·0; phosphomolybdic acid, 92·0; H_2MoO_4, 44·5; $(NH_4)_2MoO_4$, 96·0. $(NH_4)_2MoO_4$ being the best catalyst the minimum amount necessary for the reaction and the possibility of lowering the reaction temperature were investigated. The % yield of pigment for differing amounts of catalyst (with respect to phthalic anhydride) at 150 and 170°c. respectively were 0·6, 49·4, 85·5; 1·6, 74·0, 88·0; 3·0, 71·7, 87·0. Experiments in various solvents at 0·6% concentration of phthalic anhydride for 10 hr. at 170°c. gave the following % yields in benzene polychlorides 77·5; nitrobenzene, 85·5; xylene (reaction at b.p.) 30·0. The yield is remarkably higher (by 10–15%) if the reaction is carried out in presence of solvents, and moreover, a high calcination temperature is rendered unnecessary. Use of $CuCl_2$ instead of Cu_2Cl_2 results in decreased yield. C.O.C.

Anthraquinone Pigments from the Crinoid _Comatula pectinata_

M. D. Sutherland and J. W. Wells
Chem. and Ind., (9), 291–292 (28 Feb. 1959)

At least 8 pigments, totalling 5% of the dry weight, are obtained from *Comatula pectinata* by chromatography on $MgCO_3$. The pigments, ranging from orange to blue, are believed to be methyl ethers derived from rhodocomatulin—



E.V.T.

Photoreduction of Bilirubin and Protoporphyrin

V. B. Evstigneev, V. A. Gavrilova, and I. G. Savkina
Doklady Akad. Nauk S.S.S.R., **124**, 691–694 (21 Jan. 1959)

The photoreduction of bilirubin in alcohol and pyridine with ascorbic acid or phenylhydrazine has been investigated spectrophotometrically (500–700 mμ.) and it is shown that the photosensitising property of bilirubin is considerably lower than that of protoporphyrin. This is attributed to the open structure of bilirubin as opposed to the closed conjugated system of the porphyrin pigments. G.J.K.

Crystallisation of Chlorophylls (C.I. 75810)

L. P. Zill, G. Colmano, and H. J. Trurnit
Science, 128, 478 (1958): *Chem. Abs.*, **53**, 4431 (10 March 1959)

Chlorophylls *a* and *b* were separated by adsorbing the *b* on a column of sucrose. The *a* was crystallised by repeatedly washing the *iso*propanol-pentane effluent with water. Chlorophyll *b* was eluted with acetone, transferred to petroleum ether and crystallised by repeatedly washing the solution with water. C.O.C.

Photoelectric Sensitivity of Chlorophyll and its Analogues

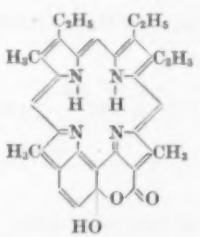
E. Putseĭko *Doklady Akad. Nauk S.S.S.R.*, **124**, 796–799 (1 Feb. 1959)

The photoelectric properties of chlorophyll (a + b), pheophytin, and ethyl chlorophyllide in different states of aggregation, adsorbed on ZnO and Pt, have been investigated using the condenser method (L. Bergmann *et al.*, *Zs. f. Phys.*, **100**, 50 (1936)). For ZnO the mechanism of sensitisation is explained on the basis of energy transfer, and not as the transfer of electrons from the pigment to ZnO. In a vacuum (10^{-4} mm.) the spectral distribution of the photoelectric sensitivity in a thin layer of chlorophyll on Pt shows in addition to the main absorption peak (~ 680 mμ.) a wide band of photoconductive response extending into the infrared region (up to 1·5 μ.). G.J.K.

Reactions in the Chlorophyll Series. Glaucorhodine

M. Strell, A. Kalojanoff, and M. Köniğer
Ann., **614**, 205–211 (1958): *Chem. Abs.*, **53**, 4295 (10 March 1959)

Glaucorhodine, a bluish violet dye of formula—



has been prepared from rhodochlorine. Rhodochlorine having a vinyl group in the 2 position when refluxed for 4 hr. with acetic acid and acetic anhydride in presence of

piperidine, pouring into ether, washing with water and ammonia and extracting with 5% HCl yields a green dye. The residual ether contains vinyl glaucorhodine, a deep violet dye with strong red fluorescence. Evidence confirming the constitution assigned to glaucorhodine is given.
C.O.C.

Action of Light on Visual Pigments

Vertebrate Lumi- and Meta-rhodopsins
R. Hubbard, P. K. Brown, and A. Kropf
Nature, **183**, 442–446 (14 Feb. 1959)

The red photosensitive pigment of the rods, rhodopsin, consists of a colourless protein, opsin, carrying neo-(11-*cis*)retinene as the chromophore. Rhodopsins from monkey, cattle, chicken, bullfrog and cusk all fit this sequence of reactions: first, rhodopsin is photochemically and reversibly isomerised to lumi-rhodopsin; this then undergoes irreversible thermal rearrangement to meta-rhodopsin, which is finally hydrolysed to opsin + retinene.

Lumi- and Meta-rhodopsins of Squid and Octopus
A. Kropf, P. K. Brown, and R. Hubbard
Ibid., 446–448 (14 Feb. 1959)

Rhodopsins from the squid and octopus are stable to hydrolysis so that the third reaction in the sequence above is not observed, thus confirming the view that visual excitation precedes the release of retinene.

Chicken Lumi- and Meta-iodopsin
R. Hubbard and A. Kropf
Ibid., 448–450 (14 Feb. 1959)

Iodopsin, the purple pigment extractible from the cones, also consists of neo-(11-*cis*)retinene + opsin. The sequence of reactions is similar to that given for rhodopsin above.
E.V.T.

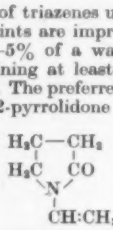
Carbon Black (C.I. Pigment Black 6 and 7) by Catalytic Decomposition of Natural Gas containing Methane
F. E. Mishel
Trudy Leningrad. Inzhener.-Ekon. Inst. (9) 107–122 (1955):
Referat Zhur., Khim. Abstr. No. 66052 (1956):
Chem. Abs., **53**, 4610 (10 March 1959)

PATENTS

Readily Diazotisable Dispersions of Arylamines
General Aniline *BP* 813,486
Equivalent of *USP* 2,845,326, J.S.D.C., **75**, 224 (April 1959). E.S.

Azoic Dyes—Improved Stability of Triazens
General Aniline *BP* 815,458

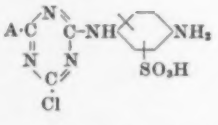
Alkaline aq. solns. of triazenes used in producing azoic dyeings and prints are improved in stability by incorporating 0·5–5% of a water-soluble polymeric material containing at least 20% of a polymeric *N*-vinyl lactam. The preferred compounds are polymers of *N*-vinyl-2-pyrrolidone



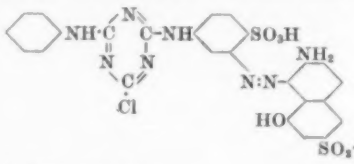
in which one or more of the H atoms in the cyclic methylene groups may be subst. by lower Alk. The optimum pH range of the soln. is 9–13 and presence of 5–50% of a water-soluble alcohol, e.g. ethylene glycol, is advantageous.
E.S.

Monoazo Acid Dyes Having a Triazine Ring
Ciba *BP* 812,957

Triazine derivatives—



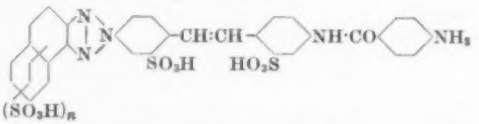
(A = NH_2, or subst. NH_2) are diazotised and coupled with a naphthylamine sulphonamide or sulphone, especially 2-amino-8-naphthol-6-sulphonamide, to give wool dyes applicable from a neutral or weakly acid bath. Thus the condensation product of 1 mol. each of cyanuric trichloride, aniline, and 2:4-diaminobenzenesulphonic acid is diazotised and coupled with 1 mol. of 2-amino-8-naphthol-6-sulphon-*N*-methylamide in presence of acetic acid to give



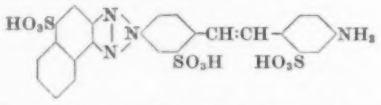
which dyes wool red.
E.S.

Greenish-yellow Monoazo Stilbene Direct Dyes having a Triazole Ring
Ciba *BI'* 814,391

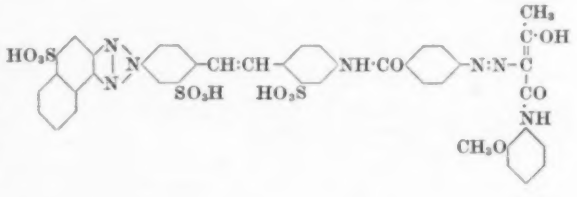
Amino compounds of formula—



(n = 1 or 2) are diazotised and coupled with acetoacetarylides (especially acetoacet-*o*-anisidide) to give the title dyes, having better wet fastness than the dyes of similar hue described in *BP* 659,130 (J.S.D.C., **68**, 99 (1952)) derived from dehydrothio-*p*-toluidinesulphonic acids. Thus the naphthotriazolestilbene compound



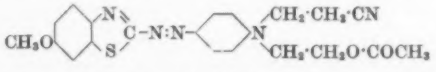
prepared according to *DRP* 695,404, is condensed with *p*-nitrobenzoyl chloride in presence of alkali, followed by reduction of the NO_2 group to NH_2. Diazotisation and coupling with acetoacet-*o*-anisidide then gives the monoazo dye



E.S.

Monoazo Disperse Dyes
Interchemical Corpn. *BP* 813,906

Diazotised amines, particularly 2-aminobenzthiazoles, are coupled with *O*-acyl esters of *N*-β-hydroxyethyl-*N*-β-cyanoethylanilines to give disperse dyes. Thus diazotised 2-amino-6-methoxybenzthiazole coupled with the acetate ester of *N*-β-hydroxyethyl-*N*-β-cyanoethylaniline gives



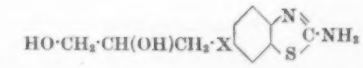
which dyes cellulose acetate bright scarlet.
E.S.

Yellow and Orange Metal(Chromium and Cobalt)-complex Monoazo Pyrazolone Pigments for the Mass Coloration of Synthetic Polymers
S *USP* 2,864,814

The title products are the 1:2 Cr and Co complexes of monoazo compounds obtained by coupling a diazotised *o*-aminophenolsulphonamide with a sulphonamide of 3-methyl-1-phenyl-5-pyrazolone. Thus the Cr-complex of the monoazo compound 2-aminophenol-4-sulphon-*N*-methylamide→3-methyl-1-phenyl-5-pyrazolone-3′-sulphon *NN*-dimethylamide colours cellulose acetate reddish-orange when incorporated in the spinning solution.
E.S.

Metallisable Monoazo Disperse Dyes
Eastman Kodak Co. *USP* 2,875,190

Derivatives of 2-aminobenzthiazole—

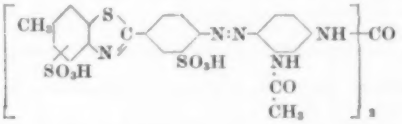


(X = S or SO_2) are diazotised and coupled with β-naphthol to give the title dyes. Thus 2-amino-6-thiocyanobenzthiazole is refluxed in ethanol with Na_2S and glycerol monochlorhydrin to give the product in which X = S. Diazotisation and coupling with β-naphthol gives the monoazo dye, which gives deep blue on cellulose acetate when aftertreated with $Ni(SCN)_2$. E.S.

Dischargeable Orange and Red Disazo Direct Dyes from Dehydrothio-*p*-toluidinesulphonic Acids

Ciba *USP* 2,875,193

Dehydrothio-*p*-toluidinesulphonic acids are diazotised and coupled with *m*-aminoacylanilides, and 2 mol. of the aminomonoazo compounds so formed are condensed with one mol. of phosgene or fumaryl dichloride to give the title dyes. Thus dehydrothio-*p*-toluidinedisulphonic acid is diazotised and coupled with *m*-aminoacetanilide and the product treated with phosgene to give—

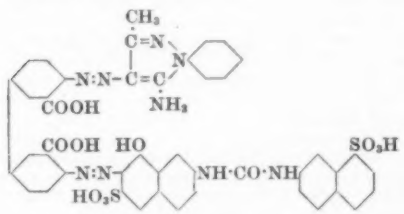


which dyes cotton yellow-orange. E.S.

Violet Disazo Direct Dyes for Aftercoppering

FBy *BP* 814,273

The title dyes are obtained by coupling tetrazotised benzidine-3,3′-dicarboxylic acid (I) with 1 mol. of a 1-aryl-3-methyl-5-aminopyrazole and with 1 mol. of an aryl urea of J acid, prepared for instance by treating J acid with phosgene and an arylamine such as *p*-aminoacetanilide or 2-naphthylamine-8-sulphonic acid (II), or by condensing a urethane of J acid with an arylamine. Thus I is tetrazotised and coupled in presence of acetic acid with 3-methyl-1-phenyl-5-aminopyrazole, and the separated monoazodiazo compound is then coupled with a soln. in aq. Na_2CO_3 of the urea obtained by phosgenation of J acid and II to give—

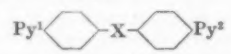


E.S.

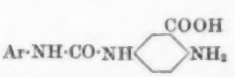
Yellow Disazo Direct Dyes for Aftercoppering

Gy *BP* 813,646

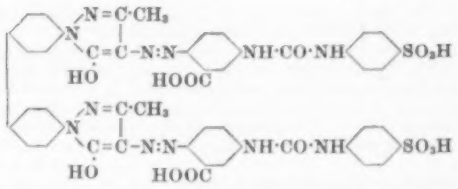
Dipyrazolones of the type—



(Py^1, Py^2 = radicals of 5-pyrazolones; X = direct link or a bridging group such as CH:CH) are coupled with 2 mol. of diazo compounds derived from anthranilic acid derivatives—



(Ar contains at least one SO_3H or COOH group) or with 1 mol. of such a compound and 1 mol. of a diazo compound derived from an *o*-amino-phenol or -naphthol, etc. to give the title dyes. Thus diazotised 4-aminodiphenylurea-3-carboxy-4′-sulphonic acid (2 mol.) is coupled with 1,1′-(4″,4‴-diphenylene)-di-(3-methylpyrazolone (5)) to give—



which dyes cellulose pure yellow by the aftercoppering method. E.S.

Yellow and Orange Disazo Colorants for Lacquers, etc.

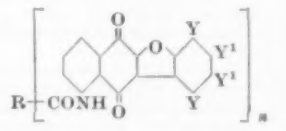
FH *BP* 814,605

4-Aminoazobenzene (I), or methyl or carboxylic acid derivatives of it, is diazotised and coupled with a 1-phenyl-5-pyrazolone-3-carboxylic acid which may contain an SO_3H group in the phenyl nucleus and the disazo compound so formed is made into a salt with an organic base to give the title products. Thus diazotised I is coupled with 1-*o*-sulphophenyl-5-pyrazolone-3-carboxylic acid, and the disazo compound, dissolved in dilute aq. H_2SO_4, is stirred with *N*-dicyclohexylamine sulphate. The salt which separates dissolves in organic solvents, cellulose nitrate lacquers, etc. with a yellowish-orange colour of good fastness to light. E.S.

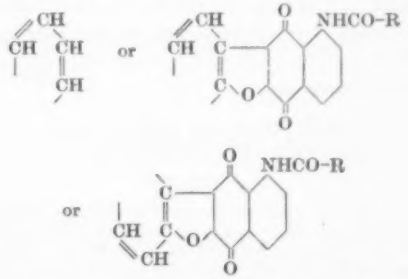
Dinaphthofurandione Vat Dyes

General Aniline *USP* 2,870,168

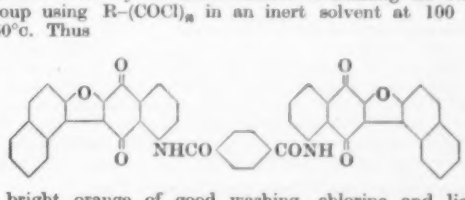
New heterocyclic vat dyes are of formula—



(one pair Y–Y^1 = H; other pair Y–Y^1 =



n = 1 or 2; R = aromatic radical bonded to C of a COOH group of a suitable aromatic carboxylic acid acylating agent). Preparation of the dyes is carried out by acylating suitable heterocyclic intermediates containing an NH_2 group using $R-(COCl)_n$ in an inert solvent at 100 to 250°C. Thus



a bright orange of good washing, chlorine and light fastness is made by using terephthaloylchloride as acylating agent in nitrobenzene at 200–205°C. for 150 min. E.T.

Benzanthroneanthraquinone Acridine Vat Dye

ICI *BP* 814,619

BP 337,741 describes (*a*) the preparation of 3-α-anthraquinonylaminobenzanthroneanthraquinone acridine, an olive-brown vat dye, by treating di(1′-anthraquinonyl)-6 Bzl-diaminobenzanthrone with alc. KOH; and, (*b*) the conversion of the above product by treatment with an acid condensing agent, e.g. conc. H_2SO_4, to a green vat

dye. The final product has very poor fastness to soda-boiling and, if the condensing agent is $AlCl_3/NaCl$, the colour of the dye is poor. In the present method, in stage (*b*), $AlCl_3$ at 125–155°c. is used but an oxidising agent, preferably *m*-nitrobenzenesulphonic acid, is added before or with the 3-*α*-anthraquinonylaminobenzanthroneanthraquinone acridine. The olive-green dye thus obtained has outstanding stability and fastness to wet treatments.

E.T.

Fluorescent Brightening Agents

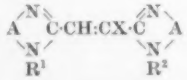
CFM *BP* 814,579

Fluorescent brightening agents which lose none of their fluorescence when applied to paper pulp in presence of melamine type precondensates or resins are obtained by treating 1 mol. of 4,4′-diaminostilbene-2,2′-disulphonic acid with 2 mol. of cyanuric chloride and then further condensing in any sequence the resulting bis[2,4-dichloro-1,3,5-triazinyl-(6)]-4′,4″-diaminostilbene-2′,2″-disulphonic acid with 2 mol. of the same or different aliphatic or aromatic compounds containing at least one H atom linked to N and at least one of which contains a carboxylic group, and with 2 mol. of the same or different primary or secondary aliphatic, monocyclic aromatic or heterocyclic amine or a heterocyclic base having a H atom linked to a ring-N atom. Thus cyanuric chloride (36·9 parts) in acetone (200) is poured into water (1000) and ice (500). At 0–5°c. a neutral solution of 4,4′-diaminostilbene-2,2′-disulphonic acid (37) in water (300) is gradually added and the mass kept neutral by dropping in Na_2CO_3 (10·6) in water (100). A neutral aqueous solution of 4-aminobenzoic acid (27·4) is then added and the mass heated to 40–45°c. for 3 hr. During this time the liberated acid is neutralised by dropping in Na_2CO_3 (10·6) in water (100). Methylamine (14) in aqueous solution is then added and the mass refluxed for 5 hr. at 80–85°c. The product, bis-[2-methylamino-4-*p*-carboxyphenylamino-1,3,5-tri-azinyl-(6)]-4′,4″-diaminostilbene-2′,2″-disulphonic acid, is precipitated by acidifying or salting out, filtered and dried at 70–80°c. Its sodium salt readily dissolves in water. Added to paper pulp in presence of melamine type condensates, it results in a paper of a very high degree of whiteness and fastness to wet processing. C.O.C.

Di-imidazole Derivatives— Fluorescent Brightening Agents

Ciba *BP* 814,249

Compounds of formula—



(A = subst. or unsubst. aromatic nucleus in which two vicinal C atoms are bound to the two imidazole N atoms; R^1 and R^2 = same or different, H, Alk, oxyalkyl or benzyl) and their salts and sulphonic acid derivatives are useful fluorescent brightening agents. Thus *αβ*-di-[benzimidazyl-(2)]-ethylene disulphonate is a light yellow powder which has intense bluish violet fluorescence in ultraviolet radiation. It is obtained by sulphonation of the condensate of malic acid and *o*-phenylenediamine. C.O.C.

Halogenation of Phthalocyanines

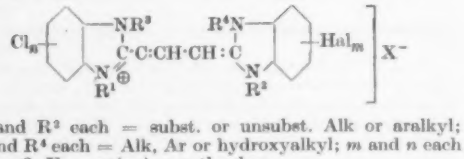
General Aniline *USP* 2,873,279

Treating a phthalocyanine with Cl or Br in a melt containing anhydrous $AlCl_3$ and a compound of S with O and Hal at 60–200°c. under atmospheric temperature is a cheap and readily controlled method of chlorination. The products after isolation need no further conditioning to make them commercially useful. C.O.C.

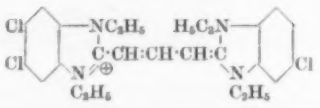
Unsymmetrical Trimethin Cyanine Dyes

Gevaert Photo-Producten *BP* 815,172

Dyes of formula—



(R^1 and R^2 each = subst. or unsubst. Alk or aralkyl; R^3 and R^4 each = Alk, Ar or hydroxyalkyl; *m* and *n* each = 1 or 2; X = anion), e.g. the dye



prepared by refluxing 1-ethyl-2-(*ω*-anilinovinyl)-5,6-dichlorobenzimidazole ethyl-*p*-toluene sulphonate with 1-ethyl-2-methyl-5-chlorobenzimidazole ethyl iodide in pyridine and acetic anhydride with triethylamine as catalysts are superior as sensitisers to the dyes described in *BP* 505,979 and leave no coloured products behind after processing. C.O.C.

Isolating High Colour Polymers from Caramelised Sugar (C.I. Natural Brown 10)

Union Starch & Refining Co. *USP* 2,873,193

A solution of caramelised sugar has the bacterial inhibitors removed from it, either by distilling the solution, by preferential solvent extraction or by ion exchangers. It is then fermented or otherwise treated to change the non-coloured sugar bodies remaining in the product to useful commercial products and finally the colour compounds are separated out to yield products whose colour value is several times that of the original caramel. The coloured product can be dried to a powder which is much less hygroscopic than ordinary dry caramel.

C.O.C.

Cadmium Sulphide–Mercuric Sulphide Pigments

Johnson, Matthey & Co. *BP* 815,328

A coprecipitate of cadmium and mercuric sulphides is produced by adding a soluble sulphide to a solution containing cadmium and mercury salts. The coprecipitate is then calcined in a gas-tight sealed container at above the normal sublimation temperature of mercuric sulphide. The products are comparable in performance to cadmium sulphoselenide pigments but have a more brilliant hue ranging from orange through red to maroon. C.O.C.

Pelleting of Carbon Black (C.I. Pigment Black 6 and 7)

Columbian Carbon Co. *USP* 2,872,336

The crushing strength and packing point of Carbon Black pellets is much increased if $\leqslant 0{\cdot}1\%$ by weight of Na tetraborate is incorporated in them. C.O.C.

Pyrotechnic Method for Increasing the Basicity of Pigments containing Lead Sulphate

C. H. Adams *USP* 2,872,333

Normal and basic lead sulphate (C.I. 77630 and C.I. 77632) or leaded zinc oxide (C.I. 77947) are mixed with lead oxide and then calcined at 500–725°c. The amount of lead oxide is that required to produce the desired basicity. Paints made from the resulting pigment do not gell even when kept for a long time. C.O.C.

Extended Pigments

Thomsen Research Co. *USP* 2,872,335

If a carbonate of Ca, Mg, Ba or Zn is suspended in aqueous TiF_4 then a basic insoluble Ti compound mixed with the fluoride of the other metal will be formed with liberation of CO_2. The individual particles of carbonate therefore increase in mass while retaining a kernel of unreacted carbonate. At the close of the reaction no trace of water-soluble Ti compound remains. If the product is to be used as a paper furnish then the Ti content of the finished pigment, which can be used in its wet state, must be 20–50% (calc. as TiO_2), for coating purposes a denser product is preferable. If a dry pigment is required then the opacity may be increased to a small extent by gentle calcination e.g. at 400°c., as the TiO_2 is already in the rutile form and more dehydration is all that is achieved by calcination. C.O.C.

Improving the Texture of Pigments

Chemische Fabrik Wesseling *BP* 815,316

The texture of pigments, especially those of the ferrocyanide blue type, is improved by treating a weakly acid to alkaline dispersion of the pigment with an amphoteric, nitrogenous, anion-active compound of formula—

$$R^1R^2N{\cdot}B{\cdot}A$$

(R^1 = H or Alk of > 5 C; R^2 = Alk, Ar or aralkyl of > 5 C; B = $-(CH_2)_x$ (x = 1–3) in which one or more methylene groups may be replaced by phenylene or naphthalene; A = COOH or SO_3H). Thus a suspension of Berlin Blue (C.I. Pigment Blue 27) was oxidised, washed

by decanting to pH 5–6 and then 1·0% (on wt. of pigment) of Na dodecyl aminobutyrate in aqueous solution stirred into the suspension. After being filtered, dried and ground a Milori Blue was obtained which could be incorporated into organic binders in one-third of the time required by the untreated pigment. C.O.C.

Ceramic Pigments
Harshaw Chemical Co. *BP* 814,761
Calcination of mixtures of zirconium oxide, silica, vanadium oxide and tin oxide at 1200–1500°C. yields green ceramic pigments. C.O.C.

Carbon Black, C.I. Pigment Black 6 and 7, from Coke-oven Gas (I p. 465)
Mothproofing Agents and Dyes (III p. 465)
Hydroxythiophenes as Azoic Coupling Components in Diazotype Reproduction (IX p. 475)
Neutrocyanines for Increasing the Sensitivity of Silver Halide Emulsions (IX p. 475)

V—PAINTS; ENAMELS; INKS

Pigment Volume Concentration. II—Effect on the Gloss of Synthetic Resin Enamels
H. Kiryu and K. Sato
Shikizai Kyokaisha, **30**, 431–7 (1957): *Chem. Abs.*, **53**, 4769 (10 March 1959)
Addition of alkyd resin to cellulose nitrate increased the gloss of paint made from it, natural-resin-modified maleic resin was better than oil-modified alkyd resin. The composition of the solvent had little effect on gloss. The gloss of vinyl resin paint was poor and decreased with increase in the amount of pigment. Addition of cellulose nitrate to resin paint decreased the gloss. Melamine alkyd resin gave good gloss which was not affected by pigment volume concentration up to 30–40% whereas cellulose nitrate alkyd resin and vinyl resin paints lost their gloss suddenly at the pigment volume concentration of 10–15%. The more alkyd resin present in the melamine alkyd resin the better the gloss up to 66% alkyd resin after which the gloss was constant. Rutile TiO_2 (C.I. Pigment White 6) showed good gloss and hiding power compared with Chrome Yellow (C.I. Pigment Yellow 34). C.O.C.

PATENTS

Carbon Paper Coating Compositions
Ditto *BP* 814,961
The base sheet is coated with a mixture of an oleaginous composition, a metal salt, e.g. nickel sulphate hexahydrate, and a hydrotrope, i.e. a substance which is soluble in both water and hydrocarbons and which when a little is dissolved in water enables a large amount of hydrocarbon to be dissolved in it, e.g. Na cymene sulphate. Presence of the hydrotrope results in copies having stronger intensity. C.O.C.

Hammered Metal Finish Compositions
Commonwealth Engineering Corpn. *USP* 2,873,261
Cross-linked polymeric polyether-polyhydric alcohols and their unsaturated fatty acid esters are exceptionally satisfactory film forming components for pigment metals which yield a hammered metal finish. The number of cross links in the polymer must be small and they must be uniformly distributed. The final composition must have 25–50% solids content and a Zahn No. 3 spray viscosity of 20–50 sec. Thus Epon 1004 (Shell) (100), soyabean fatty oil acids (70), and rosin (20) were heated to 480°F. Phthalic anhydride (7·5) was then added and the mass kept at 480°F. for 1 hr. and then cooled to 350°F. Xylol (197) and VMP naphtha (100) were added in that order and the resulting vehicle (400) worked with Medium Chrome Green (C.I. Pigment Green 15) (5) in a ball mill for 24 hr. This base (332) was then mixed with guaiacol (1·3), lead naphthenate (24% Pb) (0·8), manganese naphthenate (6% Mn) (0·5), cobalt naphthenate (6% Co) (0·5), xylol (80·0) and deleafed aluminium (C.I. Pigment Metal 1) (8·0). Sprayed on to unprimed steel panels at 30–50 lb. pressure per sq.in., with a Binks spray gun, it formed, after air drying and baking, a hard continuous film having a hammered metal finish. C.O.C.

VI—FIBRES; YARNS; FABRICS

Reaction of Sodium Borohydride with Wool
J. M. Gillespie *Nature*, **183**, 322–323 (31 Jan. 1959)
Wool can be almost completely dissolved in aqueous solutions of sodium borohydride with very much less degradation than in conventional solvents. At 20°M. sodium borohydride (100 ml.) will dissolve 92% of merino wool (1 g.) in 1 hr. at pH 10·6–11·0. The amounts dissolved under other conditions are tabulated. E.V.T.

***N*- and *C*-Terminal Groups of Hair Keratin**
M. F. Kerr and C. Godin
Canadian J. Chem., **37**, 11–12 (Jan. 1959)
The *N*-terminal and *C*-terminal residues of human and horse hair have been determined by chromatography. *N*-Terminal acids, isolated by the DNP method, are aspartic and glutamic acids, glycine, serine, threonine, alanine, and valine. *C*-Terminal acids, identified as DNP derivatives after hydrazinolysis, are aspartic and glutamic acids, glycine, serine, threonine and alanine. These are the same end-groups previously found for wool and feather keratin. E.V.T.

Synthesis of Fibre-forming Poly-*dl*-Alanine
Y. Ishizuka and T. Saito
Chem. and Ind., (9), 299 (28 Feb. 1959)
Polymerisation of *N*-carbo-substituted-phenoxy-*dl*-alanines in nitrobenzene instead of the usual pyridine-toluene solvent, is faster and gives products having higher reduced viscosities. A table showing the effect of solvent upon the durations, the yields and the reduced viscosities, for various types of substituents, is given. E.V.T.

PATENT

Static-resistant Hydrophobic Resins for Making Fibres
Union Carbide Corpn. *USP* 2,874,023
To a solution of a fibre-forming resin is added the condensate of ethylene oxide or propylene oxide with a medium- or high-mol.wt. polyvinyl alcohol. The solution is then either wet- or dry-spun to yield hydrophobic fibres having an antistatic finish which lasts throughout their useful life. C.O.C.

Apparent Redox Potential of Viscose and the Effect of Sodium *m*-Nitrobenzenesulphonate upon it (VIII below)

VII—DESIZING; SCOURING; CARBONISING; BLEACHING

PATENTS

Bleaching Wood Pulp
Columbia Cellulose Co. *BP* 815,247
A slurry of the pulp is treated with chlorine dioxide followed by addition to the slurry of a sulphite, bisulphite or thiosulphate. If desired treatment with a hypochlorite may follow so long as the pulp is not given an intervening wash. This makes easily possible production of undegraded cellulose of brightness $\not< 90$, this brightness being retained on heating or prolonged storage. C.O.C.

Bleaching Polyacrylonitrile Fibres
Chemstrand Corpn. *USP* 2,873,164
Fibres made from polyacrylonitrile containing 2–10% of a polymer of *N*-heterocyclic monomer are readily bleached to white by treating them with a 0·05–0·5% aqueous solution of a strong mineral acid, e.g. H_2SO_4 and then with an aqueous solution of 2·5–6·0% (on wt. of fibres) of $NaClO_2$ at 140–180°F. The bleached fibres are less liable to darken on exposure to light than are the original fibres. C.O.C.

VIII—DYEING

Vat Dyeing of Cotton and Viscose Packages
K. J. Bardt
Canadian Textile J., **76**, 37–43 (23 Jan. 1959)

Apparent Redox Potential of Viscose and the Effect of Sodium *m*-Nitrobenzenesulphonate upon it
E. Geiger and H. Nobs
Helv. chim. Acta, **42**, 322–327 (Feb. 1959)
The effect of the redox potential of viscose on vat-dyeing, and the effects of the oxidising salt, sodium *m*-nitrobenzenesulphonate, have been investigated. Measurements

have been made on ripe and unripe viscose dopes. The salt increases the potential from about −700 to about −550 mv. and the ageing effects are very marked. For the best dyeing results, the redox potential of the dye must be greater than that of the viscose. E.V.T.

Interaction of Surface Films with Solute in Solution. IV— Effect of Aqueous Solutions of Congo Red on Various Monolayers

M. Muramatsu

Bull. Chem. Soc. Japan, **32**, 114–119 (Feb. 1959)

Congo Red (C.I. Direct Red 28) in aq. soln. causes an expansion of surface films of octadecylamine, cetyl alcohol, ethyl *n*-hexadecyl ether, ethyl stearate, and cholesterol as compared with the corresponding films on water. The degree of expansion varies with pH and, except for octadecylamine, is a max. between pH 2 and 4·5, corresponding approx. with zwitterion formation of the dye. It is postulated that expansion of the monolayers is due to dipolar and van der Waals forces. For octadecylamine, max. expansion is at pH 5·3, where the dye now carries some negative charge and the monolayer a residual positive charge, so that ionic interaction should also be considered. A.J.

Interaction of Direct Dyes with Cellotriose

P. V. Morÿganov and B. N. Mel'nikov

Kolloid. zhur., **21**, 86–90 (Jan.–Feb. 1959)

The interaction of two direct dyes with a water soluble cellulose preparation, cellotriose (K. Hess *et al.*, *Ber.*, **68**, 1594 (1935)), has been investigated and the thermodynamic characteristics of the process have been calculated. Values obtained for the effective volume of the cellulose phase are found to be in good agreement with those of Marshall and Peters (J.S.D.C., **63**, 446 (1947)). Experiments with the sodium salts of Congo Red (C.I. Direct Red 28) and Direct Diazo Black 8 (C.I. Direct Blue 2) were conducted at 25, 35, and 45°c. with the barium salt of Congo Red at 100°c. The iodine number of cellotriose is approx. 40. G.J.K.

PATENTS

Dyeing with Iminopyrrolenine Dyes containing a Heavy Metal

FBy *BP* 814,575

Cellulose, regenerated cellulose and silk are readily dyed with aminopyrrolenine dyes of the type described in *BP* 687,655 and 698,039, if they are first mordanted with organic compounds containing acid groups. Thus cotton yarn is mordanted with tannin fixed with antimony. The condensed Co-containing pyrrolenine obtained by the process described in *BP* 759,277, is pasted with diglycol monoethyl ether, dissolved in glacial acetic acid and then diluted with water. The mordanted cotton is treated in this liquor at room temperature for 30 min. It is then rinsed, boiled for 30 min. in an aqueous bath containing formic acid and Zn sulphoxylate and then treated for 5 min. in 0·3% HCl at 60–70°c. Finally it is boiled with soda ash and hydrosulphite and then soaped. C.O.C.

Vat Dyeing of Wool

Israeli Ministry of Agriculture *BP* 814,779

Wool that has been treated with aqueous bromic acid dyes directly with leuco esters of vat dyes without any oxidising agent being needed. Thus white wool cloth (8·8 g.) was treated for 15 min. at 25°c. in 0·15 N-H_2SO_4 (200 ml.) containing $KBrO_3$ (0·024 mole/litre). It was then squeezed, rinsed for 3 sec. in cold water and again squeezed. It was then entered into a cold dyebath (350 ml.) containing Indigosol Brown IRRD (C.I. Solubilised Vat Brown 5) (2%) and Glauber's salt (30%). The bath was raised to 90°c. in 30 min. and exhausted by adding acetic acid (6%) in three portions at intervals of 10 min. Total dyeing time was 70 min. The bath remained clear and colourless throughout. The cloth was dyed a medium brown similar in depth to that obtained on untreated wool by the conventional method of dyeing; untreated wool treated in the same manner remained white and unstained. C.O.C.

Dyeing Polyester, Nylon, Cellulose Triacetate and Acetate Rayon Textiles

British Rayon Research Assocn. *BP* 814,526

Padding the textile with a disperse dye liquor containing as assistant glycerine, triethanolamine, diacetin, erythritol, pentaerythritol, ethylene glycol, diethylene glycol, diethylene glycol diacetate, D-glucose monohydrate, thiourea, urea, ammonium thiocyanate, hexamine, urea and ethylene glycol, thiourea and ethylene glycol, pentaerythritol and thiourea, glycerine and thiourea, or diethylene glycol and thiourea, and then passing it through a heated fluidised bed yields good uniform dyeings without any deleterious effect on the fibres. C.O.C.

Dyeing Polyester Fibres

FH *BP* 815,738

Linear aromatic polyester fibres are readily dyed with pigments or disperse dyes from a boiling aqueous bath containing 25–50% by weight of 1,4-dioxan. Thus a full red dyeing is obtained on Terylene by dyeing for 1 hr. at 95–100°c., liquor ratio 20:1, in an aqueous bath containing per litre 2·5 g. of the dye 1-amino-2-methoxy-4-nitrobenzene → 2,3-hydroxynaphthoylamine benzene, 5 g. of the reaction product of 20 mol. ethylene oxide with 1 mol. octadecyl alcohol and 500 g. 1,4-dioxan. C.O.C.

Dyeing Polyolefine Fibres

Vereinigte Glanzstoff-Fabriken *BP* 814,582

A solvent dye is used in a bath of a paraffin or naphthene hydrocarbon oil or an aqueous emulsion of such an oil. Thus polyethylene yarn is dyed bright carmine red with complete penetration by treating for 10 min. at 50°c. in a bath made up by dissolving C.I. Solvent Red 49 (2·5 g.) in paraffin (50 c.c.) and emulsifying it in water (1000 c.c.) with the aid of Emulphor ST special (BASF) (15 g.). The yarn is finally rinsed with cold carbon tetrachloride and boiled in aqueous soap solution. C.O.C.

Reserves for Use in Fur and Leather Dyeing

BASF *BP* 814,578

A polymer or copolymer of an *N*-vinyl lactam which is soluble in cold but not in hot water is used as a reserve in a hot dyebath, the reserve being finally washed out with cold water. Thus a lambskin has brushed on to it through a stencil a 10–20% aqueous or alcoholic solution of poly-*N*-vinylcaprolactam. The skin is allowed to dry and then dyed in an aqueous disperse dyebath at 50°c. Finally the skin is washed in cold water to remove the polyvinylcaprolactam. The reserved places remain undyed. The same effect is obtained with acid or vat dyes. C.O.C.

Hair Dye

Ashe Laboratories *BP* 815,346

An aqueous solution containing an acid dye and a salt of an acid hydrophilic colloid with a volatile base is used to tint hair, such a solution being sufficiently viscous with little solid content. The tint given to the hair has moderate fastness to leaching but is readily removed by shampooing. An example of such a composition is carboxy polymethylene (1·0% by wt.), Orange I (C.I. Acid Orange 20) (0·2), 32% ammonia (to bring to pH 7), and distilled water (to bring to 100). C.O.C.

IX— PRINTING

Optical Sensitisation of the Photographic Process

W. West *J. chim. phys.*, **55**, 672–680 (1958): *Chem. Abs.*, **53**, 4981 (25 March 1959)

In optical sensitisation, light absorbed by a layer of dye adsorbed in a crystal of silver halide introduces a free electron and a hole into the crystal. This makes a photographic emulsion sensitive in a visible or infrared range where it is normally insensitive, and it also causes photoconductivity in that range. To be effective the dye has to be adsorbed, not dissolved, in the gelatin. The activation energy is $\geq$ 0·1 e.v. Light in the absorption region of the dye may cause direct blackening without development. Two mechanisms of energy transfer from the dye to the crystal are considered: (1) Direct transfer of an electron, leaving a free radical in the dye which is subsequently neutralised by an electron from a halide ion. The activation energy calculated on this basis is too high (0·6 e.v.) but as the number of Ag atoms produced in the latent image is much less than the number of adsorbed dye molecules, total regeneration of the dye need not be assumed. (2) Transfer of energy by resonance interaction. It is difficult to explain the high efficiency of optical sensitisation on this basis unless there are energy levels in the crystal closer to the conduction band than the top of the valence band or unless there are indirect transitions between the two bands requiring less energy. A relatively long-lived excited state in the dye would make resonance

transfer more probable. Neither mechanism has yet been confirmed. Measurements of photovoltaic potentials between dyes and metals support the theory of electron transfer but paramagnetic resonance determinations have not shown presence of any free radicals in dyed silver halide. The absorption spectrum of the typical dye, 1,1′-diethyl-2,2′-cyanine bromide, adsorbed in a unimolecular layer on AgBr, depends on its concentration. At high dye concentrations a new band appears caused by the propagation of excitons through dye aggregates. Addition of adsorbable impurities, which keep dye aggregates from forming, improves the efficiency of sensitisation (supersensitisation) by causing the excitons to be trapped long enough to facilitate transfer to the AgBr. The supersensitiser may also itself take part in the electron transfer. Dyes which are not coplanar act, on the contrary, as antisensitisers. C.O.C.

PATENTS

Application and Discharge Printing with Vat Dyes on Acetate Fibres
Ciba Co. *USP* 2,874,022

Stable pastes in which a wide range of dyes can be used to yield good colour value comprise sodium formaldehyde sulphoxylate (C.I. Reducing Agent 2), a non-gelling unconverted starch and a thiourea. Use of such a starch eliminates flushing and halo formation in discharge printing on acetate fibres. Replacing part of the starch by an emulsion thickener eliminates any tendency to mark off during drying. Thus acetate cloth was dyed with 1·2% of Cibacet Blue 3GN (C.I. Disperse Blue 21) and then printed with a paste containing Crystal gum (18), thiodiethylene glycol (6), sodium formaldehyde sulphoxylate (10), emulsion thickener (20), unconverted waxy maize starch (8), thiourea (10) and water (16) and triethanolamine (10) there being also present 10 parts 6-ethoxy-4′-methyl-6′-chloro indigo per 90 parts of paste. It was then dried, aged in saturated steam at 212°F. for 5–8 min., treated at 100°F. in 2% H_2O_2 (30% vol.) and 2% acetic acid (56%) rinsed in water at 100°F., soaped at 100°F., rinsed and dried at 70°F. This yielded a sharp bright scarlet print on a blue ground. C.O.C.

Printing of Pile Fabrics
D.S.T. Pattern & Engineering Co. *BP* 815,704

Apparatus for printing pile fabrics, particularly tufted carpets, has a driven hollow roller which has an impervious cover. This cover is cut away to a depth at least equal to that of the pile so as to leave projecting elements collectively making at least one repeat of the desired pattern. Dye is fed from the interior of the roller to successive parts of its shell either internal or external to the pattern elements. The pile of the fabric is pressed against the roller so that as the roller revolves it carries the fabric forward. C.O.C.

Stencil Printing of Plastic on to Permeable Material
D & S Processing Co. *BP* 815,433

The permeable material, e.g. cloth, is led beneath a rotating cylindrical stencil. The plastic is fed into the interior of the stencil. A doctor blade is mounted parallel to the axis inside the stencil. The blade edge is at such distance from the inside face of the stencil that it cuts off the flow of plastic to the material at a predetermined height and so limits the depth of the plastic applied to the material. An elongated controlled heating means surrounds cloth as it leaves the stencil and heats it for a predetermined period. C.O.C.

Diazotype Materials Yielding Azo Dye Images by the Action of Heat or Infrared Radiation
Ilford *BP* 815,005

The diazotype material comprises on a suitable base the following layers in this order (1) a diazo compound, (2) a material which melts before the diazo compound decomposes, and (3) an azoic coupling component. C.O.C.

Azo Dye Duplicating Process
A. B. Dick Co. *USP* 2,873,668

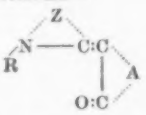
Modification of *USP* 2,748,024; 2,634,677 and 2,795,504. A much wider range of colours, including black, is obtained by using an aromatic amine in a sufficiently acidified environment to develop nitrous acid from an alkali nitrite and so diazotise the amine which then couples either with some of its undiazotised self or with any other azoic coupler present. The materials used are more stable to heat and light and are less corrosive to the apparatus. C.O.C.

Hydroxythiophens as Azoic Coupling Components in Diazotype Reproduction
Kalle & Co. *BP* 814,581

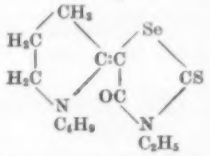
Use of hydroxy thiophene compounds as azoic coupling components enables prints to be obtained, especially by a two-component ("dry") process, having very good fastness. Used in conjunction with *p*-amino diazo compounds they give deep bluish violets and with naphthoquinone-(1,2)-diazide sulphonic acids red to deep brownish violets. Thus paper is coated with a solution containing 2-hydroxy-5-methylthiophene-4-carboxylic acid, citric acid, HCl, thiourea, urea, naphthoquinone-(1,2)-diazide-(2)-5-sulphonic acid and nickel sulphate. On exposure to light and developing with NH_3 vapour a bluish violet image is obtained. C.O.C.

Neutrocyanines for Increasing the Sensitivity of Silver Halide Emulsions
Agfa *BP* 814,375

Neutrocyanines of formula—



(R = aralkyl, subst. or unsubst. Ar, cycloalkyl, Alk or Alk subst. by carboxylic acid, carboxylic ester or sulphonic acid groups; Z = 3–7 methylene groups to complete a ring; A = atoms to complete a 5- or 6-membered ring), e.g. the yellow dye



increase the sensitivity of silver halide emulsions without deleteriously affecting dark-room safety. C.O.C.

Subtractive Colour Film Copy
E. Gretener *BP* 814,347

X—SIZING AND FINISHING

Effect of Ligninacetic Acid on the Rotproofing of Cotton Yarns and Jute Fibres
R. Khanum and Q. A. Ahmed
Pakistan J. Scientific and Industrial Res., 1, 317–319 (Oct. 1958)

Ligninacetic acid (LAA) is active against *Memnoniella echinata* and *Chaetomium globosum* in cultures. Samples of cotton and jute impregnated with 2% LAA were just perceptibly protected against these fungi as shown by the breaking strength tests. E.V.T.

PATENTS

Siloxanes as Lubricants for Cellulose-derivative Sewing Threads
Dow Chemical Co. *USP* 2,872,356

Threads of cellulose derivatives, e.g. ethyl cellulose, can be sewn with ease if they have been impregnated with a liquid diorganopolysiloxane whose organic radicals are monovalent hydrocarbon radicals attached to Si through Si–C linkages, e.g. a dimethyl siloxane polymer of viscosity 5,200 cs. at 25°C. C.O.C.

Crimped, Continuous Filament Yarn of Synthetic Linear Polymers
Inventa AG für Forschung und Patentverwertung *BP* 815,202

A bundle of untwisted parallel or pre-twisted filaments is stretched by at least 150% and is given false twist of 2000–3500 turns per metre while being stretched. Finally it is heat set while in the highly twisted state. C.O.C.

Crimped Yarn of Synthetic Organic Fibres
Heberlein & Co. *BP* 815,176

Crimped yarn of synthetic organic fibres which when knitted has a rougher, firmer handle than that given by yarn crimped by previously disclosed processes is obtained

by giving a yarn having high false twist a brief heat treatment such that the yarn surface suffers incipient softening, the yarn being then immediately cooled. C.O.C.

Dry Sizing
Maschinenfabrik Rüti *BP* 814,769

The warp or cloth passes between rollers one of which applies molten size to fibres. Excess size is removed from this roller before it meets the fibres by subjecting it to a blast of air from a nozzle extending across the width of the roller. C.O.C.

Rendering Fibrous Products Non-adhesive to Sticky or Tacky Materials
Union Carbide Corpn. *BP* 815,097

Fibrous materials when coated with a dimethyl silicone polymer of viscosity $\leqslant$ 200,000 centipoises at room temperature and then heat cured are rendered "abhesive". "Abhesive" defines the property by which adhesion or adherence of sticky or tacky materials through contact is inhibited or prevented. C.O.C.

Reducing the Tendency of Fabrics to Pill
Deering Milliken Research Corpn. *USP* 2,874,069

Fabrics containing polyester and similar man-made fibres have their pilling tendencies eliminated by treatment with an aqueous emulsion of a vinyl resin of softening point $<$ 350°F., drying and then heating to not less than the softening point of the resin. The amount of resin needed on the fabric varies from 0·8–4·0% by weight. C.O.C.

Felted Laminate of Non-felting Cloth and Press Felts
British Hat & Allied Feltmakers Research Assocn. *BP* 815,731

Two or more baths of felt fibres are arranged in face to face contact with one or more plies of woven non-feltable material through which the felt fibres can penetrate. The assembly is then hardened by the combined action of steam, pressure and a lateral jigging motion. C.O.C.

XI—PAPER AND OTHER CELLULOSIC PRODUCTS

Sizing of Paper with Organo-silicon Compounds
N. A. Afonchikov, G. V. Kolobova, P. N. Mikhaĭlov, and M. G. Voronkov
Zhur. priklad. khim., **32**, 445–446 (Feb. 1959)

Three methods of paper sizing with organo-silicon compounds were investigated. (1) Treatment of finished paper with vapours of methyltrichlorosilane, followed by the neutralisation of liberated HCl with NH_3 vapour or by the addition to the paper mass of Ca or Ba oxides or other basic compounds gives good results in a very short time, but causes slight deterioration in the mechanical properties of paper. (2) Treatment of paper with 0·001–3% sol. if methyltriacetoxysilane in an organic solvent requires a thermal process afterwards to achieve desired quality of finish. (3) By far the best method is the introduction of 0·5–3% aq. emulsion of $(C_2H_5SiOH)_n$ or $(CH_3{\cdot}Si{\cdot}OH)_3$, followed by ordinary storing for 8–12 days. The separate introduction into the paper mass of a catalyst shortens the time of storage. Suitable catalysts are benzoyl peroxide, Pb and Zn acetates, triethanolamine, $(C_2H_5)_2{\cdot}N{\cdot}C{\cdot}SSNa$ $C_2H_5O{\cdot}C{\cdot}SS{\cdot}K$ and others. T.Z.W.

Mechanism of Oxidation of Cellulose with Oxides of Nitrogen
E. D. Kaverzneva and A. S. Salova
Izvestiya Akad. Nauk S.S.S.R., otdel. khim. nauk, (2), 344–349 (Feb. 1959)

The effect of N_2O_3 and NO on the oxidation of cellulose with N_2O_4 is discussed. Optimum rate of oxidation is attained for a definite NO content in the oxidising mixture, amounting to 7–10% NO in the above investigation. The absence of N_2O_3 results in increased formation of celluiose nitrate. G.J.K.

Spectroscopic Investigation of the Oxidation of Hydroxylic Groups of Cellulose by Nitrogen Dioxide
I. N. Ermolenko, R. G. Zhbankov, N. Ya. Lenshina, V. S. Ivanova, and V. I. Ivanov
Izvestiya Akad. Nauk S.S.S.R., otdel. khim. nauk., (12), 1495–1496 (Dec. 1958)

Oxidation of cellulose with gaseous NO_2 is investigated by the infrared absorption technique (6·5–8·5 μ.) and the reaction shown to be quasi-homogeneous. In the initial stage of oxidation (up to 12% carboxyl groups) reaction is mainly with the primary hydroxyl groups; subsequent oxidation occurs with secondary and primary hydroxyl groups. G.J.K.

Physical and Chemical Properties of Carboxymethylcellulose
G. A. Petropavlovskiĭ
Zhur. priklad. khim., **32**, 241–253 (Feb. 1959)

Sodium carboxymethylcellulose is prepared by the action of monochloro-acetic acid or its sodium salt on alkali-cellulose. Most commercial types of the carboxymethyl-cellulose are of D.P. 300–3000 and 0·5–1·2 degree of substitution. It is a white fibrous or amorphous substance, soluble in water and very hygroscopic. The viscosity of its aq. sol. depends upon its D.P., concn., temp. and the pH value. The degree of substitution can be determined by the titration of free COOH groups, estimation of Na as NaCl, conductometric titration or colorimetric determination. The sodium carboxymethyl cellulose has a very high dipole moment, it is not absorbed by cellulose and has a poor surface activity. Its resistance to micro-organisms is directly proportional to the D.P. and the degree of substitution. T.Z.W.

PATENTS

Filled Papers
Rohm & Haas Co. *BP* 815,410

Formation of paper from aqueous suspensions containing the fibre and a mineral filler is greatly improved by presence of an extremely small amount of a quaternary ammonium product obtained by treating a linear polymer of $\leqslant$ 10 mole % of monomeric units of formula—

$$-CH_2-\underset{\displaystyle CO}{\underset{|}{CR}}-$$
$$\Big|$$
$$O-A-NR^1R^2$$

(R = H or CH_3; A = $-(CH_2)_2-$, $-(CH_2)_3$ or $-CH_2{\cdot}CH_2(CH_3)-$; R^1 and R^2 = same or different, CH_3 or C_2H_5) with an alkyleneoxide, e.g. the ethylene oxide quaternary of the hydroacetate salt of a homopolymer of β-(*NN*-dimethylamine)ethyl methacrylate of viscosity average mol.wt. several million. C.O.C.

Coated Paper
Rohm & Haas Co. *USP* 2,874,066

When coating paper by the processes described in *USP* 2,790,735–6, the polymer used must have two properties to provide good printing behaviour. The polymer must be soft enough to flow round the pigment particles and come into good conformity with the cellulose surface under the temperature conditions and in the very short time between application of the coating and drying, e.g. at 20–85°c. and 30–45 sec. Secondly it must contain groups which make it adhere to the paper, this is best attained by use of polymers of monoethylenically unsaturated polybasic acids as they give only a 50–70% increase in viscosity when adjusted to pH 9·0. C.O.C.

Cadoxen, a Colourless Aqueous Solvent for Cellulose (III p. 465)
Carbon Paper Coating Compositions (V p. 473)
Bleaching Wood Pulp (VII p. 473)

XII—LEATHER; FURS; OTHER PROTEIN MATERIALS

Reserves for Use in Fur and Leather Dyeing (VIII p. 474)

XIII—RUBBER RESINS; PLASTICS

Self-emulsifiable Polyester-aminoplast Condensates (III p. 466)

XIV—ANALYSIS; TESTING; APPARATUS

Cadoxen, a Colourless Aqueous Solvent for Cellulose (III p. 465)

FORTHCOMING MEETINGS OF THE SOCIETY — *continued from page x*

Tuesday, 19th January 1960

HUDDERSFIELD SECTION. *Problems in Dyeing Polyester Fibres and Means of Overcoming Them.* Dr. J. Nusslein (Farbwerke Hoechst A.G.). Silvios Cafe, Westgate, **Huddersfield.** 7.30 p.m.

Friday, 22nd January 1960

WEST RIDING SECTION. Annual Dinner and Dance.

SCOTTISH SECTION. *Some Problems on the Dyeing and Finishing of Fabrics using the Newer Synthetics from the point of view of the customer.* J. S. Ingham, Esq., M.Sc., F.R.I.C. (Marks & Spencer Ltd.). St. Enoch Hotel, **Glasgow.** 7.15 p.m.

Thursday, 28th January 1960

WEST RIDING SECTION. *Levelling Agents for Wool Dyeing.* Dr. J. Lanter (CIBA, Basle). Victoria Hotel, Bridge Street, **Bradford 1.** 7.30 p.m.

Friday, 29th January 1960

HUDDERSFIELD SECTION. Annual Dinner. Princess Cafe, **Huddersfield.**

Monday, 1st February 1960

HUDDERSFIELD SECTION. *Choice of an Artificial Daylight for Colour Matching with Special Reference to Fluorescent Materials.* F. L. Warburton, Esq., M.Sc., A.R.C.S., D.I.C., A.Inst.P. (Wool Industries Research Association). (Joint meeting with Huddersfield Textile Society.) Large Hall, College of Technology, **Huddersfield.** 7.30 p.m.

Tuesday, 2nd February 1960

NORTHERN IRELAND SECTION. *Professional Salesmanship—The Key to Prosperity.* A. B. M. Taylor, Esq. (Irish Linen Guild). (Joint meeting with Textile Institute.) York Street Flax Spinning Co. Ltd., Henry Street, **Belfast.** 7.30 p.m.

Friday, 5th February 1960

LONDON SECTION. *Dyeing and Finishing of 'Courtolon' Nylon in relation to its Yarn Properties.* L. Cotton, Esq., B.A., and J. Wardle, Esq. (Courtaulds Ltd.). Royal Society, Burlington House, **London W.1.** 6 p.m.

Tuesday, 9th February 1960

NORTHERN IRELAND SECTION. *Problems Relating to Permanent Finishes.* Dr. A. Schurch (CIBA Ltd., Basle). Grosvenor Rooms, **Belfast.** 7.30 p.m.

Wednesday, 10th February 1960

MIDLANDS SECTION. *Dyeing and Finishing of Courtolon Yarns, Fabrics and Garments.* J. Wardle, Esq., L. Cotton, Esq., B.Sc. College of Technology, **Leicester.** 7 p.m.

Thursday, 11th February 1960

WEST RIDING SECTION. *Paper Chromatography of Dyestuffs.* J. C. Brown, Esq. (CIBA Clayton Ltd.). Griffin Hotel, Boar Lane, **Leeds 1.** 7.30 p.m.

MANCHESTER JUNIOR BRANCH. *The Photo-chemistry of Aromatic Molecules and Dyestuffs.* Professor G. Porter, M.A., Ph.D., F.R.I.C., Room J/B 16, Chemical Engineering Building (Jackson Street), College of Science and Technology, **Manchester.** 4.30 p.m.

SCOTTISH SECTION *Recent Developments in Wool Dyeing.* W. Beal, Esq., B.Sc. (Geigy Co. Ltd.). (By invitation of the Textile Institute.) Scottish Woollen Technical College, **Galashiels.** 7.30 p.m.

SCOTTISH JUNIOR BRANCH. *Problems relating to Permanent Finishes.* Dr. A. Schurch (CIBA Clayton Ltd.). Technical College, George Street, **Paisley.** 7.30 p.m.

Friday, 12th February 1960

LONDON SECTION. Annual Dinner and Dance. Waldorf Hotel, **London W.C.2.** 7 p.m. for 7.30 p.m.

Tuesday, 16th February 1960

BRADFORD JUNIOR BRANCH. *Developments in the Manufacture and finishing of Terylene–Wool Fabrics.* J. B. Timis Esq. (I.C.I. Ltd.). Institute of Technology, **Bradford.** 7.15 p.m.

SCOTTISH SECTION. *The Keratin of Wool.* Professor J. B. Speakman, D.Sc., F.R.I.C., F.T.I. (Joint meeting with the Textile Institute.) The Royal College of Science and Technology, **Glasgow.** 7.30 p.m.

Tuesday, 23rd February 1960

SCOTTISH SECTION. *Some observations on the Production of Dyed Yarn for Carpets.* G. B. Angus, Esq., B.Sc., A.R.I.C., A.M.I.I.A., F.S.D.C. (J. Crossley & Sons). St. Enoch Hotel, **Glasgow.** 7.15 p.m.

Thursday, 25th February 1960

WEST RIDING SECTION. *New Work on the Dyeing of Nylon with Disperse Dyes.* H. Seaman, Esq., (I.C.I. Ltd.). Victoria Hotel, Bridge Street, **Bradford 1.** 7.30 p.m.

Friday, 4th March 1960

LONDON SECTION. *Recent Developments in Leather Dyeing.* J. H. Sharphouse, Esq. (Northampton College of Technology). Royal Society, Burlington House, **London W.1.** 6 p.m.

Tuesday, 8th March 1960

NORTHERN IRELAND SECTION. *The Dyeing and Finishing of Fabrics Containing Tricel.* R. J. Mann, Esq., B.Sc., F.S.D.C. (Courtaulds Ltd.). Grosvenor Rooms, **Belfast.** 7.30 p.m.

HUDDERSFIELD SECTION. *Paper Chromatography of Dyestuffs.* J. C. Brown, Esq., B.Sc., A.R.I.C. (CIBA Clayton Ltd.). (Joint meeting with the Huddersfield Section of the Royal Institute of Chemistry.) Silvios Cafe, Westgate, **Huddersfield.** 7.30 p.m.

Thursday, 10th March 1960

MANCHESTER JUNIOR BRANCH. Short Papers by members of the Section. Room J/B 16, Chemical Engineering Building (Jackson Street), College of Science and Technology, **Manchester.** 4.30 p.m.

MIDLANDS SECTION. *The Dyeing of Ribbons.* E. Bridge, Esq. (Joint meeting with the Coventry Textile Society.) Courtaulds Acetate and Synthetic Fibres Laboratory, **Coventry.** 7.30 p.m.

WEST RIDING SECTION. *A comparison of the Dyeing of Acrylics and Worsted Hosiery Yarns.* Dr. J. F. Gaunt (Patons and Baldwins Ltd.). Victoria Hotel, Bridge Street, **Bradford 1.** 7.30 p.m.

Tuesday, 15th March 1960

SCOTTISH SECTION. Annual General Meeting 7 p.m. Followed by *Paper Chromatography of Dyestuffs.* J. C. Brown, Esq. (CIBA Clayton Ltd.) St. Enoch Hotel, **Glasgow.** 7.30 p.m.

Wednesday, 16th March 1960

BRADFORD JUNIOR BRANCH. *The Development of a new Shrink-resist Finish from the laboratory to the Mill.* A. N. Davidson, Esq. (Wool Industries Research Association). Institute of Technology, **Bradford.** 7.15 p.m.

MIDLANDS SECTION. *Thermal Setting of Tricel.* W. F. Kilby, Esq., B.Sc., A.Inst.P. (Joint meeting with B.A.O.C.) Midland Hotel, **Derby.** 7 p.m.

SCOTTISH JUNIOR BRANCH. Annual General Meeting, 7.0 p.m., followed by a lecture *Paper Chromatography of Dyestuffs.* J. C. Brown, Esq. (CIBA Clayton Ltd.). Technical College, George Street, **Paisley.** 7.30 p.m.

Friday, 18th March 1960

MIDLANDS SECTION. Annual Dinner. George Hotel, **Nottingham.** 7 p.m.

Thursday, 24th March 1960

WEST RIDING SECTION. Annual General Meeting followed by *Problems involved in Piece Dyeing with Vat Dyestuffs.* M. Brauer, Esq. (Badische Anilin & Soda Fabrik A.G.). Victoria Hotel, Bridge Street, **Bradford 1.** 7.30 p.m.

Friday, 25th March 1960

LONDON SECTION. *The Origin of Faults in the Dyeing of Textiles.* N. Jackson, Esq. (Courtaulds Ltd.). George Hotel, **Luton.** 7 p.m.

Thursday, 7th April 1960

MIDLANDS SECTION. *Recent Developments in Dyeing Wool.* D. B. Evans, Esq. (Joint meeting with the Textile Institute.) Carpet Trades Ltd., Canteen, **Kidderminster.** 7.30 p.m.

Tuesday, 12th April 1960

SCOTTISH SECTION. *Ladies Evening.* (Details to be announced later.)

Wednesday, 13th April 1960

MIDLANDS SECTION. Annual General Meeting. *Colour Photography.* D. P. Ayres, Esq., B.Sc., A.R.P.S. College of Technology, **Leicester.** 7 p.m.

Thursday, 14th April 1960

MANCHESTER JUNIOR BRANCH. Annual General Meeting. Title of paper to be announced later. T. Vickerstaff, Esq., M.Sc., Ph.D., F.S.D.C., Room J/B 16, Chemical Engineering Building (Jackson Street), College of Science and Technology, **Manchester.** 4.30 p.m.

Tuesday, 19th April 1960

HUDDERSFIELD SECTION. Annual General Meeting. Followed by a lecture *How Colour Photography Works.* D. P. Ayres, Esq., B.Sc. (Ilford Ltd.). Silvios Cafe, Westgate, **Huddersfield.** 7.30 p.m.

MEMBERS' CHANGES OF ADDRESS

Burdett, B. C., *formerly of* The Dept. of Colour Chemistry and Dyeing, The University, Leeds 2, *to* Holmfield, Outwood Lane, Horsforth, Leeds

Carter, W. P., *formerly of* Newton Lea, Wheatley Road, Ilkley, *to* Coppywood, Curly Hill, Ilkley

Chapman, E. D., *formerly of* 22 Ford Lane, Didsbury, Manchester 20, *to* 56 Hazelhurst Road, Worsley, Manchester

Clarke, G., *formerly of* 76 Crostons Road, Elton, Bury, Lancashire, *to* 93 Dundee Lane, Ramsbottom, near Manchester

Clegg, J. R., *formerly of* 15 Highfield Avenue, Greetland, near Halifax, *to* 67 Hoults Lane, Greetland, near Halifax

Critchlow, D. V., *formerly of* 148 Rugby Road, Hinckley, Leicestershire, *to* 40 Ascot Road, Stafford

Croce, Dr. A., *formerly of* Via Matteo Bandello, 4, Milano, Italy, *to* Via G. Ferraris IO, Busto Arsizio (Varese), Italy

Desai, B. R., *formerly* Dyeing Master, Rodier Mills Ltd., Pondicherry, India, *to* Dyeing Master, Pulgoon Cotton Mills Ltd., Pulgoon (Wardha-Dist.), India

Dickson, J., *formerly of* 20 Derby Road, Heanor, Derbyshire *to* c/o Coblecrook Dyeing Co. Ltd., Alva, Clackmannanshire

Dyson, S. B., *formerly of* 8 Lindley Street, Longwood, Huddersfield, Yorkshire, *to* 29 Fir Road, Paddock, Huddersfield, Yorkshire

Edmonson, G. D., *formerly of* 9 Oakwood Drive, Roundhay, Leeds 8, *to* 157 Kirkstall Lane, Leeds 6.

Fisher, W. D., *formerly of* Braemar, 69 Holme Grove, Burley-in-Wharfedale, Yorkshire, *to* Coniston, Ben Rhydding Road, Ilkley, Yorkshire

Fowler, H., *formerly of* 534 Hyde Road, Gorton, Manchester 18, *to* 18 Shirley Avenue, Thornley Park, Denton, near Manchester, Lancashire

Goodwin, J. E., *formerly of* Rathcar, 9 Houghton Lane, Swinton, Lancashire, *to* Brodawel, Llanfaes, Beaumaris, Anglesey, N. Wales

Groves, S. E., *formerly of* Killoran, Station Road, Thurnby, Leicester, *to* 38 Swithland Lane, Rothley, Leicestershire

Haigh, H., *formerly of* 25a Central Buildings, Burnley Road, Luddendenfoot, Halifax, *to* 5 Meadow Lane, Wheatley, Halifax

Hay, J. M., *formerly of* 61 The Crescent, West Wickham, Kent, *to* 55 Hayes Way, Beckenham, Kent

Isles, E., *formerly* c/o The British Cotton & Wool Dyeing Assoc. Ltd., 22 Cumberland Street, Manchester 3, *to* Red Lea, 25 Broadway, Morecambe

Jones, R. L., *formerly of* Fairways, Coedeva Road, Cwmbran, Monmouthshire, *to* 118 Henllys Way, St. Dials, Cwmbran, Monmouthshire

Kalinowski, T., *formerly of* Flat 1, Leekbrook House, Leekbrook, near Leek, Staffordshire, *to* c/o Golden Florin Textile Mnfg. Co. (Pty.) Ltd., P.O. Box 7493, Johannesburg, South Africa

Kell, J. D., *formerly of* John Lyle & Co. Ltd., Fordneuk Street, Glasgow S.E., *to* 4 Kirkford, Stewarton, Ayrshire

Kennedy, J. C., *formerly of* 18 Willoughby Road, Hampstead, London N.W.3, *to* 101 Campden Hill Road, London W.8

Kernkamp, J. H. B., *formerly of* Beech Lawn Private Hotel, Dudley Road, Whalley Range, Manchester 16, *to* 3 Lings Walk, Peel Hall, Manchester 22

Landry, J. L. R., *formerly of* 1410 7th Street, Decatur, Alabama, U.S.A., *to* 2212 Magnolia Street, Decatur, Alabama, U.S.A.

Levin, A. H., *formerly of* Office 5, Commercial Buildings, Oxford Street, Kidderminster, *to* 28/29 Worcester Street, Kidderminster, Worcestershire

Lisle, F. H., *formerly of* 72 Grange Road, Chorlton-cum-Hardy, Manchester 21, *to* 94 Shrigley Road, Bollington, Macclesfield

McGregor, R., *formerly of* 92 Burton Road, Withington, Manchester 20, *to* 73 Palatine Road, Manchester 20

Mendonca, A. O. Prado De., *formerly of* Rua Teixeira Leite 423, AP.7, São Paulo, Estado De São Paulo, Brazil, S. America, *to* Rna Conselheiro Furtado 327, São Paulo, Estado De São Paulo, Brazil, S. America

Moody, L. E., *formerly of* Dublin Finishing Company, P.O. Box 637, Dublin, Virginia, U.S.A., *to* Putnam Chemical Corporation, Beacon, New York, U.S.A.

Moorhouse, M., *formerly of* Grange Villa, 6 Green Road, Baildon, Yorkshire, *to* 25 Hazelheads, Baildon, near Shipley, Yorkshire

Nutton, T. A., *formerly of* 128 Ashton Road, Denton, Lancashire, *to* 10 Mallory Avenue, Ashton-under-Lyne, Lancashire

O'Brien, C. S., *formerly* c/o 60 Longworth Road, Egerton, near Bolton, *to* 63 Chapel Street, Belper, Derbyshire

Oldham, H., *formerly of* 13 Milk Street, Hyde, Cheshire, *to* c/o Messrs. Courtaulds Ltd., Textilose Road, Trafford Park, Manchester 17

Park, J., *formerly of* 13 Scott Crescent, Selkirk, *to* 141 Magdala Terrace, Galashiels, Scotland

Partington, R. A., *formerly of* 22 Jopson Street, Middleton, near Manchester, *to* 444 Heywood Old Road, Bowlee, Middleton, Lancashire

Richardson, Dr. R. W., *formerly of* Messrs. Courtaulds Ltd., Coventry, *to* c/o British Celanese, Spondon, Derbyshire

Smith, B., *formerly of* 3 Oban Street, Leicester, *to* Plot 258, Glenfield Frith Drive, Glenfield, Leicester

Swanston, J. B., *formerly of* 1 Greenbank Street, Galashiels, Selkirkshire, *to* Shawbrae, Tweed Crescent, Galashiels, Selkirkshire

Talbot, W. D., *formerly of* 72 Heather Grove, Pemberton, Wigan, Lancashire, *to* Cartref Newydd, 20 Naylorfarm Avenue, Shevington, near Wigan, Lancashire

Taylor, R. A., *formerly of* Shell Chemicals Co. Ltd., 124 St. Vincent Street, Glasgow, C.2, *to* Shell Chemical Co. Ltd., 48-54 West Nile Street, Glasgow, C.1

Toy, Dr. F. C., *formerly of* Tregays, Fletsand Road, Wilmslow, Cheshire, *to* Tregays, Torkington Road, Wilmslow, Cheshire

Unwin, C. D., *formerly of* 18 Frimley Drive, Little Horton, Bradford 5, *to* 117 Dorset Street, Little Horton, Bradford 5

Umrigar, D. K., *formerly of* 44 St. Pauls Road, Manningham, Bradford 8, Yorkshire, *to* 23 Blakebrock, Flat 2, Kidderminster, Worcestershire

Uttley, A., *formerly of* 10 Andrew Street, Paisley, Renfrewshire, Scotland, *to* 3 Kenshaw Place, Larkhall, Lanarkshire, Scotland

Wright, J. C., *formerly of* Imperial Chemical Ind. Ltd., Area Sales Office, P.O. Box 39, 124 Granby Street, Leicester, *to* 2 Ash Tree Road, Oadby, Leicester

APPOINTMENTS

Advertisements relating to APPOINTMENTS VACANT, APPOINTMENTS WANTED, and MISCELLANEOUS ITEMS are invited for insertion on this page. Advertisements of Appointments Wanted are gratis to members, but must not exceed twenty-four words.

All inquiries relating to Advertisements should be addressed to THE GENERAL SECRETARY, THE SOCIETY OF DYERS AND COLOURISTS, DEAN HOUSE, 19 PICCADILLY, BRADFORD 1, YORKSHIRE.

Replies may be addressed BOX—, THE SOCIETY OF DYERS AND COLOURISTS, DEAN HOUSE, 19 PICCADILLY, BRADFORD 1, YORKSHIRE, where all communications relating to these Advertisements are treated in strict confidence.

APPOINTMENTS VACANT

DYEWORKS MANAGER
JOHANNESBURG

ASCO LTD. JOHANNESBURG, Sewing Thread Manufacturers and sole distributors in South Africa for J. & P. COATS LTD, require a fully experienced dyer with sound knowledge of wet processing of cotton, woollen and synthetic yarns to take charge of their PACKAGE DYEING DEPARTMENT. This is a permanent local post carrying a salary of £1,700 and would suit only someone prepared to emigrate. Outward passage paid. Applications, giving personal particulars and work experience, should be addressed in writing to the Personnel Manager, J. & P. Coats Ltd., 155 St. Vincent Street, Glasgow, C.2, who will interview on behalf of ASCO and give full particulars of the post.

FOREMAN DYER required for Cotton Dyehouse situated in South Wales. To be good shade matcher and able to control labour. Box V183

HARDMAN & HOLDEN LTD. require a qualified chemist for research work connected with the application of chemicals to problems in the Textile Industry. The work is varied and interesting and will involve some customer contacts. Applicants should preferably be Organic Chemists with some experience of textile chemistry.

A salary commensurate with qualifications will be paid, and there is a good Pensions Fund. Applicants are invited to send full particulars of career, qualifications and relevant details in confidence to— The Research Manager, Messrs. Hardman & Holden Ltd., Manox House, Coleshill Street, Miles Platting, Manchester 10.

REQUIRED by large and well-known public Company, situated in the Midlands, TECHNICAL DYER for synthetic woven fabrics, knowledge and experience of pad or continuous dyeing an advantage. There is a first class Superannuation Scheme in operation and assistance will be given with housing if required. Applications, which will be treated in the strictest confidence, should give details of experience, positions held, and salary required, and be addressed to the Managing Director. Box V182

THE MANCHESTER COLLEGE OF SCIENCE AND TECHNOLOGY
(Faculty of Technology in the University of Manchester)
RESEARCH FELLOWSHIPS

APPLICATIONS are invited for two Fellowships tenable in the Department of Textile Chemistry and valued at between £800 and £1,000 per annum with membership of F.S.S.U.

One of the Fellows appointed will be concerned with work on the fundamentals of the bonding of papers and should be qualified in either Chemistry, Chemical Engineering, Paper Technology or Textile Technology. The other Fellow will be expected to work on the physical properties of fibre assemblies and should, therefore, be a qualified Physicist or Textile Technologist.

Applications, which must include full details of the training and industrial and research experience of the applicant, and the names of two referees, should be addressed to the Registrar, The Manchester College of Science and Technology, Manchester 1, by 7th November 1959.

STEAD, MCALPIN & CO. LTD., P.O. Box 1, Carlisle, invite applications for the position of WORKS CHEMIST. Experience in the application of Vat colours by Screen and Machine required, together with a sound knowledge of processing and finishing. H.N.C. or equivalent. Age 25–35. This position offers good prospects to the successful applicant. Apply in writing to Personnel Officer at the above address, stating experience, age, and qualifications. All applications will be treated as confidential.

SENIOR TEXTILE CHEMIST

LARGE Woolcombing organisation has opportunity for qualified person, aged between 30 and 40 years. Responsible position involving Technical Research, Chemical and Physical Testing, Development work and trials in the Processing Factories of the company. For a suitable Qualified Chemist with a textile background and effective personality the position is an important one with remuneration in keeping with responsibilities and ability. Excellent superannuation scheme. Applicants should submit full details of experience and qualifications in confidence to Box V181.

THE MANCHESTER COLLEGE OF SCIENCE AND TECHNOLOGY

Appointment of

FULL-TIME TEACHER IN THE DEPARTMENT OF TEXTILE CHEMISTRY

THE Council of the College invites applications for the appointment of a Full-time Teacher in the Department of Textile Chemistry.

The chief duties will be to give practical instruction for classes in the Bleaching, Dyeing, Printing and Finishing of Textiles. First-hand experience in industrial practice is essential and the successful candidate will be required to assist in operating and maintaining, for experimental and teaching purposes, the new and extensive full scale processing machinery in the College Dyehouse.

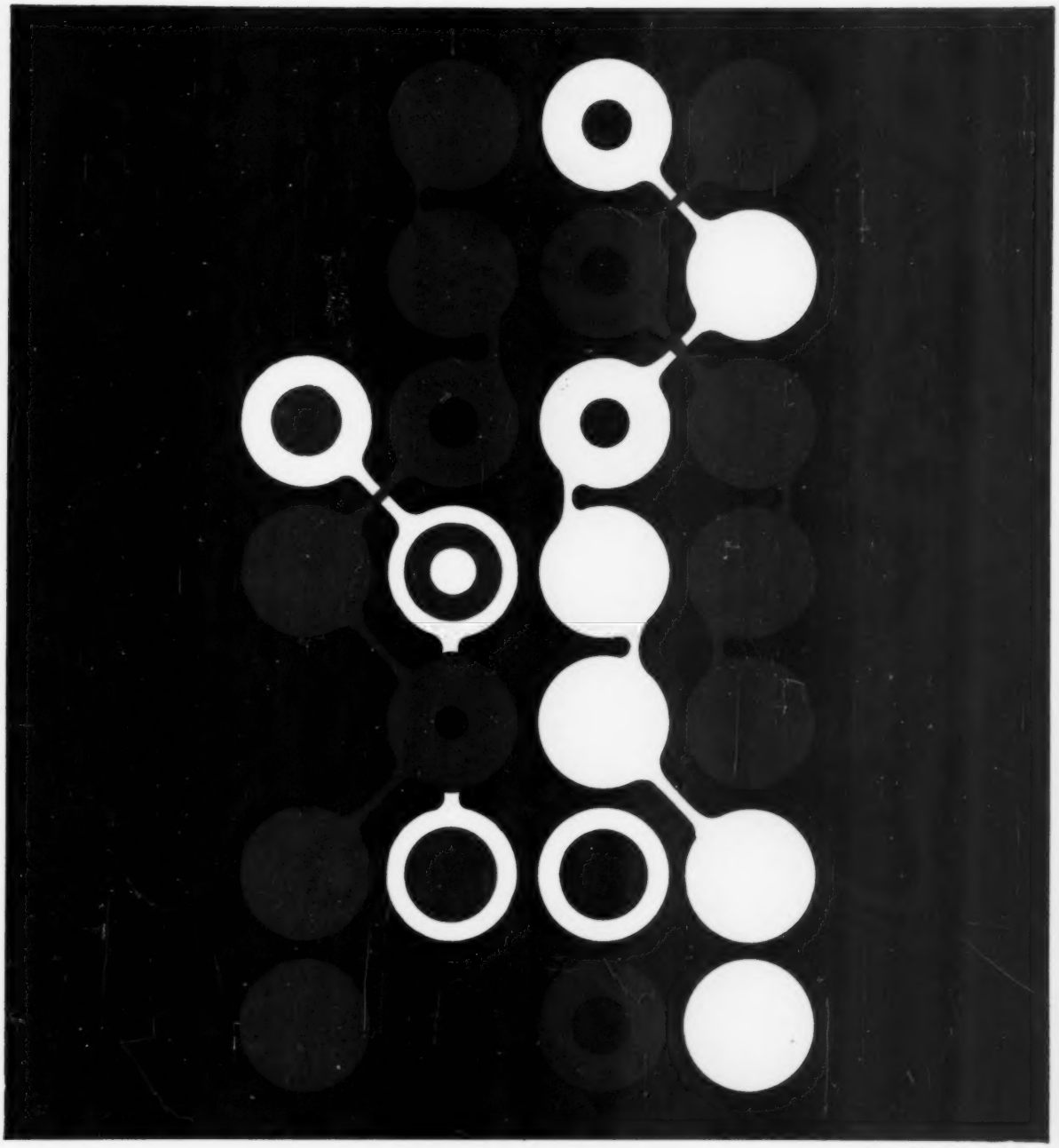
Salary Scale— £700 × £27 10s. 0d. (15) and £37 10s. 0d. to £1,150 per annum. Additions are made to this scale for approved degrees or other professional qualifications and increments within the scale may be allowed for full-time teaching or industrial experience.

Form of application may be obtained from The Registrar, The Manchester College of Science and Technology, Manchester 1. Last date for the receipt of applications is Saturday, 7th November 1959.

B. V. BOWDEN
Principal of the College

APPOINTMENT WANTED

DYER Manager, long and varied experience. Natural and Synthetic fibres, Woven and Knitted fabrics and footwear. Proved ability, desires change as Manager. Box W616



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Excellent working properties
for ease of application by
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methods and by padding to
cellulosic and synthetic fibres

The Geigy Company Ltd Rhodes Middleton Manchester

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xxvi	ANDREW ENGINEERING & DEVELOPMENT CO LTD
xlv	J C BOTTOMLEY & EMERSON LTD
i	BRITISH TITAN PRODUCTS LTD
xxii	BROTHERTON & CO LTD
vi	BROWN & FORTH LTD
xxiv	CATOMANCE LTD
xxv	CATOMANCE LTD
xxvii	CIBA LTD
xx	CIBA CLAYTON LTD
xlii	COLNE VALE DYE & CHEMICAL CO LTD
xxix	FARBENFABRIKEN BAYER A G
xlii	CHAS. FORTH & SON LTD
xxviii	GEIGY CO LTD
xlvii	GEIGY CO LTD
xvi	GLOVERS (CHEMICALS) LTD
ix	HARDMAN & HOLDEN LTD
xxi	HEXORAN CO LTD
ii	HICKSON & WELCH LTD
xxx	L B HOLLIDAY & CO LTD
xxxi	HUNT & MOSCROP LTD
xii	IMPERIAL CHEMICAL INDUSTRIES LTD
xxxiii	IMPERIAL CHEMICAL INDUSTRIES LTD
xvii	LAPORTE CHEMICALS LTD
xlii	H K LEWIS & CO LTD
xxxviii	LONGCLOSE ENGINEERING CO LTD
xxxiv	MATHER & PLATT LTD
xlviii	SIR JAMES FARMER NORTON & CO LTD
xiv	SAMUEL PEGG & SON LTD
xlv	L J POINTING & SON LTD
xix	JAMES ROBINSON & CO LTD
xi	SANDOZ PRODUCTS LTD
xiii	SANDOZ PRODUCTS LTD
xxxii	SANDOZ PRODUCTS LTD
iv	SAUNDERS VALVE CO LTD
v	SHELL CHEMICAL CO LTD
xlv	SHIRLEY DEVELOPMENTS LTD
xviii	F SMITH & CO (WHITWORTH) LTD
xliv	STANDARD CHEMICAL CO
xv	STOCKPORT UNITED CHEMICAL CO LTD
xxxvii	TENNANTS TEXTILE COLOURS LTD
viii	W P THOMPSON & CO
xxxvi	TOWN END CHEMICAL WORKS LTD
xliv	J B WILKINSON (CHEMICALS) LTD
xliv	WILLIAMS (HOUNSLOW) LTD
xxxv	YORKSHIRE DYEWARE & CHEMICAL CO LTD